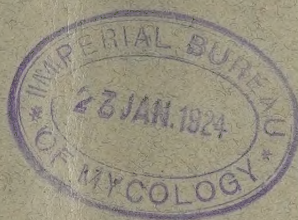


IMPERIAL
DEPARTMENT OF AGRICULTURE
FOR THE WEST INDIES



REPORT

ON THE

AGRICULTURAL DEPARTMENT
DOMINICA,

1922-23.

BARBADOS.

ISSUED BY THE IMPERIAL COMMISSIONER OF AGRICULTURE
FOR THE WEST INDIES.

1923.

[Price Sixpence.]



REPORTS
ON THE
BOTANIC STATION, ECONOMIC
PLOTS, AND AGRICULTURAL
EDUCATION, DOMINICA.

Annual Reports on Certain Economic Experiments conducted in connexion with the Botanic Station, 1900-2.

Annual Reports on the Botanic Station for the years 1901 and 1902.

Annual Reports on the Botanic Station, Economic Experiments, and Agricultural Education for the years 1902-3 to 1921-22.

IMPERIAL
DEPARTMENT OF AGRICULTURE
FOR THE WEST INDIES



REPORT

ON THE

AGRICULTURAL DEPARTMENT

DOMINICA,

1922-23.

BARBADOS.

ISSUED BY THE IMPERIAL COMMISSIONER OF AGRICULTURE
FOR THE WEST INDIES.

1923.

[Price Sixpence.]

LETTER OF TRANSMITTAL

Commissioner of Agriculture—to Administrator, Dominica.

D. 1236.

Trinidad,

30th May, 1923.

Sir,

I have the honour to forward the Report on the Agricultural Department, Dominica, for the year ended March 31, 1923.

2. It is unfortunate that work in the Gardens has had to be curtailed owing to restriction of expenditure.

3. The Report as usual contains much valuable information relative to the industries of the island. In this connexion the investigations concerning lime seed oil are of note.

4. It is to be regretted that "Withertip" disease of limes made its appearance during the period under review. The precautions to be taken in preventing its spread by labourers should be carefully observed. The visit of the Assistant Curator to Florida will, doubtless, prove of much assistance in regard to the adoption of measures for the control of the disease, and in this connexion the trials with resistant varieties will be watched with interest.

5. Manurial experiments with Cacao and Limes continue to form an important feature of the Department's activities. The value of carefully kept records of the results from such experiments, year after year, cannot be overestimated. The results obtained in connexion with the Lime Experiment Station are of great importance to the Presidency, particularly now that withertip disease has made its appearance: these results should serve to indicate what may be done and what may be expected on estates in the coastal areas under scientific management.

6. Useful observations have been made on the growth and flowering periods of the lime tree and the abnormal flowers of the spineless lime. These have both scientific and practical interest.

7. In spite of difficulties arising from the general depression the work of the Department is maintained at a high level, thanks to the indefatigable efforts of its officers.

I have the honour to be,

Sir,

Your most obedient servant,

FRANCIS WATTS,

Commissioner of Agriculture
for the West Indies.

CONTENTS.

	PAGE.
Work in the Gardens and Observations on Plants	1
Work in the Nurseries and Distribution of Plants	1
Plant Importations	2
Notes on Economic Products	4
Lime Seed Oil—Its description and Commercial Value.	
The Chief Industry	6
Lime.	
Chief Exports	8
Notes on Minor Cultivations	9
Work Connected with Insect and Fungus Pests	10
Withertip Disease of Limes—Orange Moth—Collar Rot of Limes.	
Report on Lime Experiment Station	26
Results of Manurial Experiments.	
Report on Manurial Experiments with Cacao	37
Plant Legislation in Dominica	38
Details of Administration	40
Meteorological Returns	42
Comparative Rainfall, Temperature, etc.	

STAFF

STAFF OF THE AGRICULTURAL DEPARTMENT, DOMINICA.

JOSEPH JONES	...	...	...	...	...	{ Agricultural Superintendent and Curator of the Botanic Gardens and Experiment Stations.
ALFRED KEYS	...	...	...	...	...	Assistant Curator.
F. J. BAPTISTE	...	...	...	...	...	Foreman.
W. G. HUTTON	...	...	...	...	...	Clerk.
A. JOSEPH	...	...	...	...	...	Overseer.

REPORT ON THE AGRICULTURAL DEPARTMENT, DOMINICA,

For the Year ended March 31, 1923.

Work in the Gardens and Observations on Plants.

Owing to the existing depression which necessitated strict economy in every direction, the Votes for the Agricultural Department were reduced to a point which barely sufficed to maintain the various cultivations in fair order, and which limited the work of the Botanic Gardens to mere routine. Under such conditions improvements were impossible, and the period under review may be best described as one of stagnation in garden matters. In the case of the Experiment Station the reduction in the Vote, (a proceeding which is to be regretted in the case of an institution which pays its own way), put an end to development work. The lime and other citrus plots were only maintained in good order by withholding from other planted areas in the Station, under other products, the cultural operations which were necessary for their progress and well-being.

It is to be hoped that this unsatisfactory general condition which now hampers progress in all directions will soon pass away. An early return to a more progressive policy in cultural and other matters in the Experiment Station is certainly much to be desired.

There is little to report in the matter of ornamental plants. Although a number of economic plants of great interest have been introduced which are referred to on another page, only one flowering plant calls for special mention. This is *Dombeya punctata*, presented by the United States Department of Agriculture. It has proved a strong, quick grower, and a very welcome addition to its class in the Gardens.

Work in the Nurseries and Distribution of Plants.

Plant distribution during the current period has fallen to one half of the distribution of 1898. The plant distribution for the year 1898 was 20,000 and, up to the past year, was the smallest distribution on record for the last 30 years.

The number of lime plants sent out during the year shows a decrease of over 12,000 compared with the year 1921-22, and over 47,000 compared with the distribution of 1913-14—a normal year.

DISTRIBUTION AND IMPORTATION OF PLANTS.

In last year's report the falling off in distribution was very properly attributed to the depressed state of the market in regard to lime products. Whilst similar conditions have been partly the cause during the past year for the falling off in the number of lime plants distributed, there can be no doubt that the appearance of withertip has been largely responsible for the present curtailment of the number of plants sent out.

There was no demand for cacao plants during the year.

The number of plants sent out during the year was as follows :—

Limes	...	...	...	7,175
Budded W. N. Orange	...	...	...	252
" Grapefruits	...	...	...	102
" Tangerines	...	...	...	2
Grafted mangoes	...	...	...	22
Coffee	...	...	...	50
Vanilla	...	...	...	2,025
Nutmegs	...	...	...	22
Miscellaneous	...	...	...	282
Pois doux (<i>Inga laurina</i>)	...	...	...	100
Cloves	...	...	...	6
Total				10,038

The following supply of miscellaneous seeds, seedlings, and cuttings was also distributed :—

Vegetable seeds	...	...	...	1,414 packets.
Onion seedlings	...	...	...	23,600
Sugar cane cuttings	...	...	...	8,150
Shade tree cuttings	...	...	...	1,160
Horse beans	...	...	...	5 lb.
Tephrosia candida	...	...	...	13 "
Elephant grass plants	...	...	...	1,000
Lemon grass plants	...	...	...	1,500

The raising of lime plants in the Government nurseries has been in progress for a number of years, and planters have hitherto depended on this source of supply. Whilst a few planters during recent years have undertaken to a certain extent the work of raising lime plants in their own nurseries, the good example of the few has not been followed, as it should have been, by other planters.

Now that the efforts of the Department are to be mainly directed towards the output of budded citrus, avocado pears, grafted mangoes, bananas, etc., it is desirable that this measure of "self help" in regard to the raising of lime plants on estates should be extended and taken up by all. During the coming year only a very limited number of lime plants will be available for distribution.

PLANT IMPORTATIONS.

In the progress Report for 1920-21, mention was made of the arrival of a consignment of seeds of the Chaulmoogra tree, *Taraktogenos Kurzii*. These were obtained through the good offices of the Director of Kew Gardens from the Calcutta Botanic Gardens. Very few of the seeds germinated after the long journey; four plants only being raised. One of these died while in the nursery; the remaining three were placed out and are now doing very well. At the end of the year the best specimen had attained a height of six feet. The other two, though smaller, are in a healthy state. Under Dominica conditions this species is likely to prove a fast grower.

Early in the year the Commissioner of Agriculture drew the attention of this Department to a pamphlet issued by the United States Department of Agriculture

entitled "The Chaulmoogra Tree and some related species" by J. F. Roek, this being an account of botanical investigations carried on by the author in Siam, Burma, Assam and Bengal.

This led to a request being made to the United States Department of Agriculture for plants of the several species raised from seed collected by Dr. Rock, and it resulted in the early arrival in good condition of two plants of *T. Kurzii*, four of *Hydnocarpus anthelminthica*, and four of *Hydnocarpus castanea*. In addition a supply of plants of *Oncoba echinata*, the source of "Gorli" seeds of Sierra Leone, which belongs to the same family as the Chaulmoogra tree, and also yields chaulmoogra oil, was kindly offered and accepted by this Department. The last named are expected to arrive in the spring of 1923.

There are now growing in the Gardens eight individuals of this interesting group, namely, four specimens of *T. Kurzii*, two of *H. anthelminthica*, and two of *H. castanea*. A few are held in reserve in the nurseries.

A considerable amount of attention has been centred on the Chaulmoogra tree during recent years, owing to the satisfactory results which attended the use of the derivatives of this oil in the case of a large number of patients under treatment in the Leper Hospital at Honolulu. Owing to the many difficulties which have to be overcome in the search for these fruits in far distant forests, it is now probable that small areas within the tropics will be planted with Chaulmoogra trees and allied species, in order to furnish fresh seed true to name, and also to complete the investigation of seeds of related species, which are thought to yield oils of equal value in the treatment of leprosy.

In November eight seeds of *Picralima Klamiana*, an African tree, were received from the Director of Kew with the following note:—

"A tree 30 to 80 feet high, found from the Gold Coast to the Congo, doubtfully also in Uganda. The seeds contain a bitter alkaloid, and are stated to be widely used in Tropical Africa as a remedy for malarial fever in place of quinine. Their therapeutical properties have apparently not so far been tested by the medical profession."

Unfortunately, none of the seeds germinated. It is hoped, however, that a further supply will be forthcoming in due course.

Seeds of a very interesting tree, *Lucuma nervosa*, known in Florida as the Egg Fruit, were collected by the Assistant Curator during his visit and brought by him to Dominica. Every effort will be made to establish this valuable plant in the Gardens.

The single large specimen of the Zapote Negro of Mexico, *Diospyros Ebenaster*, fruited in the Gardens for the first time. Compared with the description given upon introduction, the specimens were found to be large; some being 6 inches in diameter and weighing 30 oz. The fruit, which is very soft when ripe, is dark green in colour, and contains 5 to 6 brown seeds, and a considerable amount of edible matter. The latter, which varies in colour from dark brown to black, is unattractive in appearance and lacks flavour. It is unlikely that a fruit of this type will ever rank very high in public estimation.

Notes on Economic Products.

LIME SEED OIL.

Some years ago investigations in connexion with this matter were undertaken by Dr. Tempany, Government Chemist for the Leeward Islands, and the results were referred to in a paper by him on the "Feeding and Manurial Value of Lime Seed" published in the West Indian Bulletin, Vol. XV. During the year under review further work on this subject was undertaken at the Federal Laboratory, Antigua, and a sample of oil was forwarded to the Imperial Institute for analytical examination and commercial valuation. In due course the following report came to hand :—

"The lime seed oil which is the subject of this report was forwarded to the Imperial Institute by the Acting Colonial Secretary, and is referred to in his letter No. 2875/22 dated the 29th June, 1922.

It was stated that a considerable quantity of the seed is obtained annually as a waste product in the lime fruit industry, and it was desired to ascertain the commercial value of the oil in the United Kingdom. Notes were furnished of experiments which had been carried out on the seed and oil by the Government Chemist and Superintendent of Agriculture.

DESCRIPTION.

The sample weighed about 5 pounds and consisted of a greenish-yellow, slightly cloudy liquid oil, with a bitter and unpleasant taste. A small amount of mucilaginous material was present.

RESULTS OF EXAMINATION.

The oil, after filtration, was found to have the following constants, which are shown in comparison with corresponding figures obtained by the Government Chemist and by Dr. H. A. Tempany and quoted in the above mentioned notes :—

	Present sample.	Figures recorded by Govt. Chemist, Leeward Islands.	Figures recorded by Dr. Tempany.
Specific Gravity	0.9236 at 15°/15°C.	0.9138 at 27°/15.5°C.	0.9160 at 28.5°/25.5°C.
Refractive Index	1.4635 at 40°C.	1.4740 at 28°C.	1.4700
Solidifying Point of Fatty Acids	34.9°C.	—	—
Acid Value	13.6	11.2	—
Saponification Value	197.7	193.6†	165.2†
Iodine Value (Hubl, 17 hours) per cent.	109.5	100.75	153.9
Unsaponified matter, per cent. ...	0.4	0.72	—
Volatile Acids, soluble*	0.27	—	—
Volatile Acids, insoluble* ..	0.48	—	—

*Cubic centimetres of deci-normal caustic potash required to neutralise the acids from 5 grms. of oil.

†Calculated from the Saponification Equivalent given.

COMMERCIAL VALUE OF LIME SEED OIL.

The foregoing figures show that lime seed oil is generally similar in chemical properties to cotton seed oil, and experiments were therefore carried out to ascertain whether, after refining, it would be suitable for edible use.

It was found that on refining with alcohol or caustic soda the oil lost its bitter taste. The treatment with caustic soda yielded a more palatable product than was obtainable by the use of alcohol, but the refined oil did not in either case possess the bland taste required for edible oils.

COMMERCIAL VALUE.

Samples of the crude oil and the oil refined with caustic soda were forwarded to manufacturers for opinions as to their quality and probable value. They reported that the oil would not be suitable for refining owing to the inferior quality of the refined oil and the loss incurred in the process. The crude oil, however, would be quite suitable for soap manufacture, and could be used in admixture with linseed oil for certain industrial purposes. The crude oil should be saleable in moderate quantities in the United Kingdom if it can be offered at a price not exceeding £30 per ton c.i.f. (September 1922).

REMARKS.

From the results of the present investigation it will be seen that lime seed oil would probably be saleable in fair quantities, and if a trial consignment of a few tons can be forwarded the Imperial Institute will be glad to assist in disposing of it in London."

The Government Chemist (the Hon. A. E. Collens) adds the following notes to the report :—

"It would appear evident that lime seeds are capable of yielding a fairly high percentage of vegetable oil, exceeding that of cotton seed.

The percentage yield of oil in lime seeds is higher than the corresponding yield in cotton seed (29-30% by trial expression as against 17-18% by actual expression in St. Vincent).

The actual oil contained in the seed amounts to 35% as compared with about 20-22% in cotton seed and 18% in Soya beans.

On analytical comparison, lime seed cake is relatively richer in proteins etc. than cotton seed cake.

So far,—from limited feeding data,—lime seed cake though not relished at first, is soon appreciated by cattle and pigs who thrive on it, whereas so far as pigs are concerned cotton seed meal soon causes symptoms of poisoning."

The production of limes in Dominica during the past five years shows an average annual output of 400,000 barrels of fruit. After allowing for the export of 20,000 barrels of fresh limes, the amount of seed from the remainder would, calculating at 2 lb. of air dried seed per barrel of limes, amount to 380 metric tons. If a single firm could succeed in attracting the bulk of this amount to Roseau for the extraction of oil and the production of seed cake, a small annual trade of a value of several thousand pounds would be brought into existence, upon which reasonable profits would, in all probability, be earned. It is understood that the equipment required for this purpose is simple, and would not involve much in the way of capital. If this work could be taken up on an estate which already possesses power and hydraulic presses, the additional expense for machinery would be very small indeed.

Under present conditions some of the lime seed is used for feeding pigs, a portion finds its way to the pens for use as manure, but undoubtedly a very large amount is thrown in the rivers and streams or otherwise wasted.

The Chief Industry.

LIME JUICE PRODUCTS.

The crop shipped during 1922 was an average one. Calculated, as usual in barrels of a capacity of 4.55 cubic feet, the produce exported represented 399,297 barrels of fruit.

The lime crop for the past five years calculated in barrels of fruit is recorded below :—

1918	...	...	...	...	...	318,000
1919	...	...	...	...	...	402,000
1920	...	...	...	...	...	369,000
1921	...	...	...	...	...	516,000
1922	...	...	...	...	...	400,000

The following table calculated on the usual basis* shows the disposal of the crop under the following heads :—

Product.	Barrels of fruit.	Approximate percentage of total crop.
Concentrated juice	243,333	60.9
Raw juice	38,237	9.6
Fresh limes	24,389	6.1
Citrate of lime	85,785	21.5
Citric Acid	6,940	1.7

Comparison with the figures of last year's disposal of crop shows the following changes. The proportion shipped as concentrated juice fell from 66.2 to 60.9 per cent. and that shipped as raw juice rose from 2.9 to 9.6 per cent. Fresh limes

showed a slight improvement, having risen from 4.2 to 6.1 per cent. Citrate of lime dropped from 26.6 to 21.5 per cent., while Citric acid, which now makes its first appearance in this column, represents 1.7 per cent. of the total crop. The small business carried on in pickled limes and in lime juice cordial absorbed 613 barrels of limes only.

The weather conditions were favourable throughout the year in the south districts of the island. The centre and northern parts were visited by a severe rain storm on April 8, which caused some damage to cultivations and also to roads and bridges.

* 50 gallons of concentrated juice represents 75 barrels of lime fruits: 7½ gallons of raw juice represents 1 barrel of lime fruits: 1 ton of citrate of lime is equivalent to 266 barrels of lime fruits 1 ton of citric acid is equivalent to 400 barrels of lime fruits.

THE LIME INDUSTRY.

The position of the lime industry during 1922 is recorded below :—

Products.				Quantity.	Value. £
Concentrated Lime juice	...	...	...	162,222 gallons	44,611
Raw Lime juice	...	...	...	286,782 „	17,924
Lime juice cordial	...	...	...	4,226 „	911
Fresh Limes	...	...	...	24,389 barrels	23,225
Pickled Limes	...	...	...	444 „	450
Citrate of Lime	...	...	...	6,450 cwt.	22,575
Citric Acid Crystals	...	...	...	38,864 lb	3,400
Essential oil of limes	...	...	...	76,150 „	7,615
Otto of limes	...	...	...	24,267 „	10,305
					£131,016

AGRICULTURAL EXPORTS.

CHIEF EXPORTS.

TABLE OF AGRICULTURAL EXPORTS FOR THE TRIENNIAL PERIOD 1920 TO 1922.

	1920.	1921.	1922.
<i>Lime Products :</i>			
Concentrated juice...	154,040 galls.	227,716 galls.	162,222 galls.
Raw juice	273,082 "	112,317 "	286,782 "
Lime juice cordial ...	7,640 "	...	4,226 "
Distilled lime oil ...	58,151 lb.	51,524 lb.	76,150 lb.
Essenced oil of limes ...	20,234 "	18,551 "	24,267 "
Citrate of lime	6,090 cwt.	10,328 cwt.	722,400 "
Green limes	19,422 brls.	21,883 brls.	24,389 brls.
Pickled limes	645 "	399 "	444 "
Citric Acid	...	2 cwt.	38,864 lb.
<i>Cacao Products :</i>			
Cacao	5,284 cwt.	6,764 cwt.	640,304 lb.
Prepared Cocoa	816 lb.	1,223 lb.	311 "
<i>Coco-nut Products :</i>			
Coco-nuts	706,979	299,787	214,289
Copra	...	...	4,990 lb.
<i>Coffee Products :</i>			
Coffee	13 cwt.	10 cwt.	4,531 lb.
<i>Sugar Products :</i>			
Rum	69 galls.	...	265 galls.
Syrup	14,046 "	400 galls.	£43 worth
<i>Spices :</i>			
Vanilla	1,318 lb.	486 lb.	1,569 lb.
Nutmegs	£7 worth	£93 worth	...
Ginger	24 brls.	29 brls.	2,600 lb.
<i>Honey Products :</i>			
Honey	656 galls.	3,412 galls.	227 galls.
Bees-wax	125 lb.	...	...
<i>Various Products :</i>			
Bananas	1,492 bunches	2,944 bunches	3,381 bunches
Oranges	1,303 brls.	1,294 brls.	1,564 brls.
Mangoes	£330 worth	£1,036 worth	7,880 crates
Grape fruits... ..	...	...	326 "
Pears	...	...	1,091 "
Miscellaneous fruits ...	£66 worth	£238 worth	...
Bay leaves	144 cwt.	...	...
Bay oil	2,432 lb.	3,000 lb.	3,143 lb.
Orange oil	1,856 "	844 "	1,867 "
Kola nuts	£3 worth	£25 worth	£10 worth
Cassia fistula	£143 "	£86 "	£50 "
Tamarinds	75 brls.	...	56 brls.
Vegetables	£60 worth	£56 worth	...
Farine	18 bushels	...	...
Hides and skins	£42 worth	33	42 lb.
Plants, bulbs and seeds ...	...	...	...
Fruits, jam and jellies ...	342 lb.	523 lb.	539 lb.
Hats	...	...	£15 worth
<i>Forest Products :</i>			
Hardwood	79,706 feet	221,215 feet	71,219 feet
Firewood	760 cords	£16 worth	239 tons
Logwood	8 "	...	...
Canoe Shells	152 "	62	21
Hoops	2,300 hoops	£204 worth	...
Shingles	82,000	86,230	58,350
Other wooden manufactures ...	...	...	...
Charcoal	£40 worth	£47 worth	5,307 lb.
Total values	£224,037	£201,418	£150,213

Notes on Minor Cultivations.

The subject of minor industries in Dominica was discussed at some length in the Progress Report for 1921-22. As it is unnecessary to go over this ground again, it is now only intended briefly to refer to several matters which have come up for discussion during the year under review.

Bananas. Both planters and peasants were keenly interested for several months over the possibilities of banana cultivation being taken up on estates and small holdings on the Leeward Coast.

Mr. Stanley, the representative of a syndicate of British capitalists formed, it is understood, for the purpose of starting banana growing in British Guiana and in several of the West Indian Islands, visited Dominica in January and explained the views of his principals at a public meeting. After listening to Mr. Stanley's proposals, the meeting of planters decided to place the matter in the hands of a small committee for further consideration. This committee finally decided that owing to the difficulties of transport in Dominica, the price offered, 1/9 per straight bunch, would not permit of a profit being made under present conditions, and the suggestion was advanced that a minimum of 2/6 per straight bunch would be necessary to induce planters to enter upon an agreement to grow and supply bananas over a period of five years. The syndicate was not prepared to pay this figure, and regret was expressed that the state of internal transport should have operated so adversely in this connexion.

During October, while the subject of banana growing was at its height, one of the lime nurseries at the Morne was given up, and an area sufficient to accommodate 200 banana plants, at 12x12 ft. in the rows, and 16x16 ft. between the rows, was formed in its place in order to serve as a demonstration plot in case banana growing should be taken up on some scale. Although the weather was abnormally dry from October to April, the plants have done very well and a good deal of interest has been taken in the plot.

It is not generally known locally that in the event of this cultivation being undertaken at some future time with a view to the export of fruit, the present methods of growing bananas in this island would require some alteration in procedure in order to permit of the production of bunches of standard size. Unfortunately, events in this connexion have taken such a turn as to exclude general public interest in banana growing for export, but endeavours will be made to carry on the plot for several years. The results will be noted, and these may be of sufficient interest for publication in future reports.

Logwood Extract. The suggestion to utilise local supplies of logwood was brought forward by an experienced planter, who thought that something might be done at this juncture with the considerable amounts of logwood in existence along the Leeward Coast, much of which has remained uncut for twenty-five years. A number of factories for producing this extract are operating in Jamaica, but it is not easy to obtain information in respect to the methods in vogue. Evidently a considerable amount of power is required in the process of preparing logwood extract, and it would be difficult to provide this in Dominica without a very considerable outlay. The matter is still under consideration.

Castor Seeds. Information was received from both London and New York to the effect that very large supplies of these seeds could be absorbed by the markets at moderate rates, and that the demand for large quantities is likely to be a lasting one. That is to say, this product is wanted, not by the ton, but by hundreds of tons. It would appear from the quotations now ruling that 1½d to 1¾d per lb. is the best that can be offered locally. Whether the peasants, who place little value on their time, would be prepared to grow this product for the price offered remains to be seen, but it is hardly likely that estates could grow and sell at this rate and make a profit. With some improvement in price, such as would allow both planter and peasant to engage in the cultivation, very considerable quantities of castor seed could be produced in this island.

Fruit Growing. Dominica has already worked up a small trade in shipping various fruits, which should, owing to the uncertainty regarding the future of the

lime industry, now receive every possible attention with a view to further development. This can only be brought about, in a considerable way, by planting fruit trees of the best kinds, such as Julie Mangoes, high class Grapefruits, and selected Avocado Pears, while some further business might be developed by cultivating the small luscious oranges known locally as Portugals and Sweet Limes, and by planting the best varieties of Tangerines.

In growing fruit for export, the question of transport which is such a serious drawback in Dominica has to be considered. It may therefore be pointed out that all the fruit trees mentioned can be grown to perfection on lands along the Leeward Coast.

The present situation in regard to fruit exports is shown below. Although fresh limes are mainly shipped in barrels, the quantity is expressed in the table as standard crates of 2 cubic feet capacity for the sake of uniformity. The following shipments were made between January 1st and October 31st, 1922, a period of ten months.

Standard Crates.			
Fresh Limes	...	...	49,350
Mangoes	...	...	7,878
Oranges	...	...	2,334
Grapefruits	...	...	62
Avocado Pears	...	...	759
			60,383

During the same period 2,689 bunches of bananas and 165,976 coconuts were exported.

It will be clear to all that at least a section of the community must have learned a good deal about the handling, packing, and shipping of fruit, and further to have succeeded in establishing satisfactory business relations in this connexion in other countries. On the whole, Dominica is in a favourable position in this respect, and planting operations, the only way to increased production, can be entered upon with more confidence than is usual in countries in which fruit growing for export is in the initial stage.

Work Connected With Insect and Fungus Pests and Their Control.

WITHERTIP DISEASE OF LIMES.

It is a matter of great regret that withertip, one of the three diseases referred to in the annual Agricultural Report of 1918-19, has now made its appearance on lime trees in this island.

The following paragraph is reproduced from the 1918-19 report :—

“The enemies of the lime tree in Dominica are well known, and these have been carefully studied by the officers of the Agricultural Department. It may be well to remind planters that there are also other enemies of lime cultivation without the gates. Although every precaution is being taken to prevent their entry, it is not improbable that sooner or later one or more of these pests, which in some countries have caused great damage to citrus cultivation, may be introduced by some means and thus add to the already long list of difficulties which the planter has to fight,

against. The more prominent diseases which are affecting citrus plants in other countries at this time, and which are not present in Dominica, are: the Citrus Canker in the United States; the White Fly, (*Aleurocanthus woglumi*); and the withertip of limes, (*Colletotrichum gloeosporioides*.)"

At the time of writing the report from which the above extract has been taken, withertip was known to exist in Florida, Cuba, Porto Rico, Trinidad, and Demerara. It was natural, therefore, to expect that the time was not far distant when this disease would appear in Dominica, and so link up this island with other diseased areas to form a complete line of infection over the countries, in which limes are grown, extending from Florida to Demerara.

Up to the early part of May 1922 when withertip disease of limes was first observed in Dominica, the lime industry of this island had not been threatened by any fungus diseases of a kind difficult to control. When withertip first made its appearance the question arose as to whether the disease had been recently introduced, or as to whether it had been present for some years unsuspected, or unnoticed. A few planters held the latter view; but from observations made since the first outbreak came under the notice of the Agricultural Department, there would appear to be ample evidence to support the view that the disease is of very recent introduction.

It must be admitted that in the early stages of the outbreak it would be an easy matter for those not acquainted with the disease to confuse the symptoms of withertip with the damaged appearance of the young shoots caused by an insect. The damaged appearance of the young lime shoots caused by wind and insects has, in the past, often been observed, and it is probable that this condition, which is still met with, has led to the mistaken idea that withertip has been with us for a number of years. That a damaged condition of lime leaves might easily be passed over as a matter of no importance can be understood; but it is very doubtful indeed, had withertip been present in the past, if planters could have overlooked prominent disfigurements, such as are now found on the fruits of trees affected by this disease.

The first outbreak of withertip was reported from La Fontaine Estate on May 8, and the same day specimens of diseased parts were forwarded to the Imperial Commissioner of Agriculture for examination.

Between May 10, and 17, a careful search for symptoms of disease on other estates in the neighbourhood of the outbreak showed that the attack was confined, so far as the south of the island was concerned, to a comparatively small area extending over four adjoining estates, and the adjoining boundary cultivations on two others.

On May 18 the Mycologist of the Imperial Department of Agriculture arrived in the island, and investigations were immediately undertaken.

By June 15 a complete round of the island had been made; and many parts in the interior, where limes are growing under wet conditions, had been visited; but no evidence of the fungus could be found outside the Bellevue—Grandbay district. A visit to the northern and windward districts was again made a fortnight later with the same result.

After making careful investigations locally, the Mycologist returned to Barbados and there continued his investigations with diseased material collected during his visit to Dominica. Subsequently a report by the Mycologist on his visit was forwarded to His Honour the Administrator by the Imperial Commissioner of Agriculture, and was printed and distributed amongst planters.

SUBSEQUENT SPREAD OF WITHER TIP FROM THE BELLEVUE—GRANDBAY AREA TO OTHER PARTS OF THE ISLAND.

So far as close observations have been able to show, withertip remained confined to the Bellevue district until the end of June, when it was reported as being widespread on an estate in the Mahaut Valley. A week later the disease was observed on an estate in the Roseau Valley.

THE SPREAD OF WITHER TIP DISEASE OF LIMES.

The fact that these two valleys are distant about 8 and 4 miles respectively from the scene of the original outbreak, and that the intermediate cultivations between the original and each of the new points of infection remained at that time free from disease, rather suggests that the spores of the fungus had been carried on the clothes of labourers belonging to the Bellevue-Grandbay district who were known to be employed on the estates where the new outbreaks occurred.

From these new centres of infection the disease spread in both cases up and down the valleys, infecting estates on all sides. From these two valleys the disease appears to have spread on to estates in the interior where, under the heavy rainfall, the conditions are highly favourable to its growth and rapid spread.

The following extract taken from a further memorandum by the Mycologist, (published by the Government) is of interest at this stage, dealing, as it does, with the identification of the fungus, and the spread of the disease into the Mahaut and Roseau Valleys.

"Cultures of the *Gloeosporium* isolated by me from withertip in Dominica have been compared with a culture of *Gloeosporium* isolated by the Mycologist in Trinidad and forwarded recently by the Assistant Director of Agriculture in Trinidad. The two fungi appear to be identical, but different in certain particulars from the fungus described by Clausen from Cuba material as *Gloeosporium limetticulum*. Recent work by Burger throws doubt on the validity of Clausen's species and indicates that it, as well as the Dominica-Trinidad fungus, may be strains able to attack the lime, of the widely distributed and usually saprophytic species of *Colletotrichum gloeosporioides*, Penz.

The presence of withertip in the Mahaut and Roseau valleys suggests the possibility of transmission on the clothes and tools of labourers. It would therefore be a simple and obvious precaution for planters to have the clothes of men coming from other districts washed and their cutlasses disinfected before allowing them to work among their limes. The spores of the fungus on clothes are killed in a minute or two by contact with boiling water. The blade of a cutlass can be disinfected by passing through a fire until it is too hot to touch. The handle end should be immersed in 5 per cent. Jeyes, (one ounce to a pint), or similar disinfectant, for some hours, preferably overnight".

Commencing about the first week in July the disease spread rapidly from the two new areas of infection and the Bellevue-Grandbay district, and by October 1st, few of the principal lime cultivations in the island remained unaffected.

Those estates which were free of disease at this stage of its spread were more or less isolated by wide stretches of forest land. It is not known by what means the disease reached the north-east of the island in the space of a few weeks, but it is evident that spores must have been carried there, as the intermediate cultivation between that district and others in which the disease had been observed remained at that time unaffected.

Once established there, however, the disease behaved as it had done in the Roseau and Mahaut valleys where, like the Lasoye district, lime cultivations are practically continuous with little or no bush land between each property, and spread rapidly until the whole of that locality became infected.

INVESTIGATIONS IN CONNECTION WITH WITHER TIP.

In order to ascertain to what extent withertip was spreading, much travelling and close observation was necessary during the three months following the first outbreak of disease. It was at first thought that something might be done to isolate the diseased area by prohibiting the transportation to other parts of the island of limes or any other material likely to serve as a means of spreading the fungus. Such restrictions, however, which would have been difficult to enforce, were no longer considered when it was known that withertip had begun to make its appearance in other districts.

Once the investigations into the spread of the disease had shown it to be spreading rapidly, and to be present in many parts of the island, certain observations were commenced with a view of collecting information respecting the damage being caused by the disease, as it remained to be seen at that stage how withertip would behave under the climatic conditions in Dominica. A search for lime trees showing immunity to disease was also undertaken, and this line of work, which now includes observations on other citrus plants, is being steadily followed up.

Since withertip, like other fungus diseases, is known to be favoured under wet conditions, two areas under mixed citrus cultivation inland, at elevations of from 1,200 feet to 2,000 feet, and with an annual rainfall of from 160 to 180 inches, were chosen for observation purposes.

The attacks of the disease have been most severe in wet districts possessing rich humus soil and situated at elevations exceeding 1,000 feet. At elevations below 1,000 feet most damage has been done to trees growing in narrow cold wet valleys; whilst in open sunny positions on the Leeward coast, with an annual rainfall varying between 40 and 70 inches in the different parts, and where the soil is naturally or artificially drained, and contains less humus than the upland soils, the attacks have been comparatively slight.

The damage to flowers, fruits, and young shoots in the two wet districts under observation has been very great. The districts have been visited at frequent intervals, and the progress of the disease has been carefully watched. At first the young shoots were the parts most severely attacked, the attacks being worse as each new flush of growth appeared during spells of wet weather; but later on as the trees ceased to put out new growths—for the most part secondary growths after the normal growths had been destroyed—the disease became more conspicuous as a fruit and blossom blight.

Of the trees under observation the most severely attacked was a batch of 6 year old plants growing in deep humus soil, in which was planted as a ground cover, or catch crop, onions, sweet potatoes, and other vegetables.

These trees put out several lots of young growths during the period July-October, all of which were attacked one after the other as they appeared, the tip of each shoot attacked bending over at a point on the stem weakened by the fungus. At the point where the shoot is badly attacked on the stem, a small round bead of gum may often be seen exuding from the wound. Such tips, once they have become bent over, soon turn completely brown, and finally black as they shrivel up.

When first attacked, and before the shoot bends over and withers up dark coloured patches, which later on turn a light brown, appear on the leaves. These diseased patches are found mostly on the margins of the leaf, so that when these parts fall away, as they do when they become dry, it is an easy matter, where the leaves only, and not the shoots are attacked, to mistake this damage to the leaf for the damage caused by an insect. The more mature of the young leaves are often covered with light green patches, and in some cases, round patches of brown, which latter, when they become dry, also fall away, leaving the leaf punctured with holes.

The damage caused to the flowers and fruit by withertip is unmistakable: the former turn brown and usually have a water soaked appearance, whilst the latter may have one or more black patches on the rind. When the fruits are attacked in the early stages, that is, soon after they have set, the black patch becomes a depression, and working its way into the fruit causes it to fall in most cases long before it has reached the size of a pea. Some fruits may reach the size of a small walnut before they fall, but never larger if they have been attacked in the early stages. When fruits are attacked after they have reached the size, say, of a large marble they usually get through. In such cases the wound caused by the fungus gradually heals over, and becomes a light brown wart-like prominence as the fruit develops.

DAMAGE TO CROPS.

An attempt has been made to estimate crop losses by observations in the field. Though this method must necessarily mean a good deal of guess work, it has shown roughly what are likely to be the losses in such districts. Later on a more accurate estimate can be made by comparing a crop reaped under withertip conditions, with the average of previous years grown in the absence of the disease.

From observations made in these two wet districts, it is safe to place the losses at 80 per cent. or 90 per cent. These figures apply to the second crop, the first crop, which was a fairly good one, being well advanced before withertip appeared in these two areas.

What the losses are likely to be over a whole crop throughout the island will only be known about the end of 1923 or the beginning of 1924, after a complete year under withertip conditions has been experienced. Observations in the Experiment Station, where the losses are practically nil, should when compared with those of the inland areas, throw some light on what is to be expected on estates which occupy a position midway between the two extremes.

WITHERTIP IN THE EXPERIMENT STATION.

The Experiment Station is an example of cultivation on the Leeward coast, which, so far, has not suffered greatly from withertip. Planted as it is with many other kinds of Citrus plants besides limes, it will be possible to make useful observations in this valley for comparison later on with observations made elsewhere under wetter conditions.

The soil for the most part is a hungry one, very hard when dry, and rather sticky on the surface during wet weather. The situation of the cultivation is a sunny one, with an average annual rainfall for the last 30 years of 76 inches. The land has been well drained and the growth of weeds is kept in check by frequent cutlassing and hoeing. Withertip appeared in the Experiment Station early in July on one or two trees, but in spite of the weather conditions at that time being favourable to the spread of the fungus the disease made little progress.

Up to the time of writing the attack has been mild, the trees found to suffer mostly being the budded limes—particularly the spineless type—and three plots of seedling lime trees growing near the lower end of the valley in deep humus soil.

The damage done to the crop this year in the Experiment Station is practically nil, but it remains to be seen in the future whether the disease will continue to exist in a mild form, and without doing any appreciable amount of damage. Much depends on the weather during the first six months of the year, when most of the young growths and flowers are produced.

The flowering period in the Experiment Station extends from January to July. Commencing in January the flowering period for the first crop reaches its height about February-March, and for the second crop about May-June. Interesting observations in connexion with the flowering and growing periods of the lime tree in the Experiment Station were made during the year. The results will be found at another page in this report. These show that the periods of activity in every respect take place during the first seven months of the year.

Though the dry season falls within the first six months of the year, it can never be depended upon to come at a set time every year within that period; and this irregularity, though slight, is sufficient to make all the difference each year in the presence of withertip—as to whether the first or the second crop will be the one to get through with a minimum of loss. Should the dry spell come in the first three months of the year the first crop will be the main one, as it has always been in the past, with few exceptions; but should the dry spell come during April-May-June, the second crop, or what used to be the smaller of the two, may be expected, under such conditions, to become the main crop.

THE CONTROL OF WITHER TIP.

Recommendations for the control of withertip were made by Prof. Ashby, and these, together with other informations including directions for mixing and applying fungicides, have been printed in leaflet form by the Agricultural Society and distributed to planters for their guidance.

Since the publication of the information referred to above, the Assistant Curator has visited Florida, the object of his visit being that of investigating measures practised in that State for the control of withertip.

A report by the Assistant Curator on his mission to Florida was published by the Government, and copies of the published report were distributed locally.

The Assistant Curator left Dominica on January 25, and returned to the island on March 14 after an absence of seven weeks. The section of this report dealing with control measures, and other means of overcoming present difficulties in Dominica is summarised below :

Withertip is a serious disease and one difficult and costly to control in an island like Dominica where the rainfall is heavy, and where the rugged nature of the country prevents the use of power sprayers—the only type of machine that can be expected to give satisfactory results, since hand sprayers are not capable of giving the necessary pressure to force the fungicide into the trees.

Bordeaux mixture, (3-3-50 formula), plus 1 per cent, oil is recommended as the best fungicide to use in the control of withertip. The oil added to the Bordeaux acts as a sticker, and as an insecticide for the control of scale insects. Should scale insects show a great increase in numbers it is probable that independent applications of insecticides will be necessary to keep this pest in check.

Burgundy mixture has been used in Florida, and although it is safer to use, it does not last as long as Bordeaux. Lime and Sulphur solution, according to the results obtained in Florida, is useless in the control of withertip.

Dusting has given poor results in Florida and cannot be recommended, except for the control of certain insect pests. Experiments on a small scale, however, might be worth trying in Dominica, since dusting eliminates the cost of hauling water, and therefore, should this method give satisfactory results under the climatic conditions of Dominica, it would undoubtedly prove to be the cheapest means of dealing with the disease. The difficulty of finding a suitable sticker to add to dust mixtures has not yet been overcome; the addition of powdered glue, flour and other substances to the dusts having been found unsatisfactory in trials made in Florida.

The "American Beauty," a small portable dusting machine, is strongly recommended for use in this island. The machine is strapped to the back of the operator, and is capable of dusting trees up to 25 feet in height. It would be a useful machine to use in the control of the orange moth—a pest doing considerable damage in certain parts of Dominica. In conjunction with spraying operations the pruning away of all diseased twigs, taking care to cut well back into healthy tissue, is strongly recommended.

In regard to spraying operations there is some doubt as to whether planters will be able to afford more than three applications of fungicide. It is recommended therefore that an attempt be made to control withertip by giving the three applications as follows :—

- (1) As a clean up spray just before the trees become active.
- (2) At the height of the flowering season.
- (3) At about the thirtieth day after the second application.

In view of the heavy rainfall in Dominica and the fact that the flowers are subject to spray injury, the following periods for applying the fungicide have also been recommended.

- (1) As a clean up spray just before the trees become active.
- (2) At the time when most of the flowers have dropped their petals.
- (3) As many subsequent applications at intervals of ten days as may be necessary to protect the fruits until they have become hard enough to resist the entrance of the fungus.

The oils used in the Bordeaux-oil mixture are of two kinds, viz :—the Diamond Paraffin, and the Atlantic Red Engine oil. The first is a light oil and is the one most commonly used; the Atlantic Red, which is a heavy oil, being suitable only, under Florida conditions, for applying when the trees are dormant, or during rainy periods. The Atlantic Red oil is more effective in controlling scale insects than the Diamond Paraffin.

Under the heavy rainfall of Dominica the Atlantic Red may be the best to use, since it is not readily washed off the leaves. The heavy oil, should not, however, be used during the flowering period. Whichever oil is used 1 per cent. is the quantity added to the Bordeaux at each application except the one applied to the flowers. When spraying during the flowering period only 0.5 per cent. of oil should be added.

The cost of home-made Bordeaux oil mixture is estimated at about 1c. per gallon. The cost of spraying material for one tree per annum, allowing 3 gallons for each of the three applications, works out at 9c. or \$9.72 per acre. where the trees are planted 20 × 20 ft. apart. To this sum must be added the cost of applying the material to the trees, and the purchase and upkeep of spraying machines. The actual total cost of spraying an acre of limes in Dominica can only be ascertained by experiment.

Whilst spraying is advocated as a control measure, it is recommended that, as a means of permanently overcoming present difficulties in Dominica, a search should be made for new varieties of limes, or any other suitable kind of citrus showing resistance to the disease, with the object of replacing the present lime with resistant forms.

A list of sour-fruited citrus immune to withertip, and recommended for trial in Dominica, is given below :—

Persian Lime
 Woglum's round seedless Lemon
 Kusai Lime
 Lime-quat, 3 varieties—Eustis, Lakeland, and Tavares.
 Woglum's Lime (Indian)
 Tahiti
 " "
 Bears' Seedless Lime
 Rangpur Lime
 Calamondin Lime (*Citrus mitis*)
 Citrus hystrix (The Mount McQuiling form)
 Citrus Webberi
 Sour pomelo & its hybrids
 Lemon-lime hybrids (hybrids of Lime & Lemon)

The Persian Lime, Woglum's round seedless Lemon, and the Kusai Lime are the ones most likely to be of value in Dominica; although the others—especially the second three on the list—are well worth introducing either for trial as substitutes, or for hybridizing purposes.

WITHERTIP ON OTHER PLANTS.

Since the outbreak of withertip on limes, a few planters and others, who have suspected the presence of the disease on Pois doux, Mangoes and various citrus other than limes, have sent in to the Department for examination specimens of such of the above mentioned plants as were found showing symptoms similar to those caused by the fungus, whose activities are believed to be entirely confined to the

lime plant. These specimens have, from time to time, been forwarded to the Mycologist for examination and, with the exception of the grapefruit specimens on which spores of *Colletotrichum Gleosporiodes* were present, have been found not to be attacked by the particular species of fungus which works on the lime.

As to whether the lime withertip is able to attack any citrus other than the lime is still in doubt. This is a matter which is being closely watched, and further investigations are necessary before it can be decided whether or not other species of citrus are liable to be attacked by the strain of fungus now attacking the lime.

From information obtained in Florida, it would appear that *Colletotrichum Gleosporiodes*, confines its activities to the lime, and does not attack other citrus. Whether grapefruits and oranges will prove immune to the attacks of this fungus in Dominica remains to be seen.

ORANGE MOTH.

The orange moth is a pest which has been known to exist in Dominica for a number of years, but so far no serious attempt has been made to control it. Formerly it was met with only on two adjoining estates in the interior. During the past year, however, it has been observed elsewhere in the interior, and also on the coast lands.

The damage done to oranges by the orange moth renders the fruit worthless for marketing, and as most of the fruits attacked fall from the trees before reaching maturity, only very occasionally can any of the attacked oranges be used for cueulling purposes. Two years ago the losses on one estate caused by the depredations of this pest amounted to about 10 per cent of the total crop. During the past year the losses are reported to have been very much greater. Up to the present the orange moth has confined its activities more or less to the Washington Navel orange.

Although not yet identified this moth closely resembles, and is believed to be allied to, the codling moth; and like this destructive apple pest, the caterpillar tunnels in the flesh of the fruit, and on reaching maturity makes what appears to be its exit through a small hole, which it bores in the rind of the fruit. Once this moth has been identified, and something is known of its life history, it will be possible to make definite recommendations for its control.

Should the orange moth be found on identification to be possessed of habits similar to those of the Codling moth, it is possible that spraying or dusting at the time when the petals are falling from the flowers, as is practised for the control of the Codling moth, will prove to be the best and surest way of keeping this pest in check. A special dusting mixture consisting of 85 per cent of sulphur and 15 per cent arsenate of lead is prepared by the Niagra Sprayer Co., and is said to be effective in the control of the Codling moth. It is possible, therefore, that trials with this dust, using the small American Beauty duster for applying the material, may prove it to be just as effective in the control of the orange pest.

From time to time specimens of the adult and other stages of this moth have been collected and forwarded to the Imperial Department of Agriculture for identification.

During the past year as many as 1,000 "wormy" oranges were cut open throughout the season for the purpose of obtaining the caterpillars, from which it was hoped to raise the moths in captivity. Only twelve of these fruits, however, had caterpillars in them, and of the twelve caterpillars secured two were preserved in the caterpillar stage, and were forwarded to the Imperial Department of Agriculture along with six caterpillars just entering the chrysalis stage, and four moths which emerged in the local laboratory. Some of these specimens were sent on by the Commissioner of Agriculture to the Bureau of Entomology in London, but owing to the fragile nature of the moths, they did not reach their destination in a condition satisfactory for identification purposes.

COLLAR ROT OF LIMES.

Planters are again reminded that collar rot of lime trees is a disease which is capable of doing considerable damage in lime cultivation where the first symptoms of infection are overlooked or neglected. Fortunately it is a disease which can be easily checked, provided the simple treatment recommended in last year's report be given as soon as the first symptoms of the disease are observed.

Planters would be well advised to keep a sharp look out for the early symptoms of this trouble and treat any diseased trees they may find according to the directions given in last year's report.

The method then recommended for treating the roots of the trees with lime and sulphur solution after first removing the soil from around the trunk of the tree, has been practised in the Lime Experiment Station during the last two years with excellent results. All the trees so treated—some of them badly effected—have completely recovered.

Considering that the treatment is neither costly nor difficult to carry out, and considering also what it means to save a full bearing tree whereas if it were allowed to die, 5 years would have to elapse before its place would again be filled with another tree of a like bearing capacity, planters should not hesitate to give this apparently small, though important, matter their attention when occasion demands.

THE RAISING OF DISEASE-RESISTING VARIETIES OF CITRUS PLANTS SUITABLE FOR THE PRODUCTION OF CITRIC ACID.

Now that withertip disease has made its appearance on lime trees in this island, the future of the industry will depend very largely on what can be done to control the disease at a reasonable cost. In the event of remedial measures failing to maintain a profitable condition of the lime industry, it will be necessary to substitute for the present lime tree some disease resisting variety of citrus, possessing equally good bearing qualities, and yielding a juice with a citric acid content of from 12 to 16 oz. per gallon.

As control measures, consisting of spraying and dusting, are likely to be both difficult and expensive, owing to the broken nature of the country and the heavy rainfall, the question of raising a substitute for the present lime deserves most attention.

Whilst considering these two possible means of overcoming the present difficulties, the fact that there are two branches of the industry to take into account, namely, the production of fresh fruit as well as juice for the manufacture of citric acid, must not be overlooked.

Though a new variety of citrus might solve the problem from a citric acid point of view, it might not meet the requirements of the green lime trade. Therefore, important as is the citric acid side of the question, the green lime trade must also receive some attention; and expensive as spraying or dusting may prove to be, it might still be found practicable, over small areas in favoured situations on the coast lands, to practice this measure of control in order to permit of a profitable continuance of this small, though important branch of the industry, for which a new variety of citrus might not prove suitable. It is probable that, given suitable manurial treatment and proper attention to drainage and other cultural operations, many cultivations of the present lime in the drier districts on the coast lands will continue to give reasonable yields without any spraying at all, but this remains for future experiments to determine.

In connection with plant breeding work and other efforts now being made to secure immune varieties, *Citrus hystrix*, two Italian lemons, and the Rangpur lime, are receiving special attention. None of the above mentioned plants would be suitable in themselves as a substitute for the present lime, but it is hoped that good results may be obtained by crossing each of these with the ordinary lime. These plants are receiving special attention at the moment on account of there being no

other sour fruited varieties of citrus in the Garden collection. Later on, when bud-wood and plants can be secured of those plants recommended in the Assistant Curator's report, special attentinn will be given to the most promising kinds.

There is some doubt as to whether citrus trees can be hybridized with the satisfactory results attending the hybridization of other plants. Though a few false hybrids may be expected, the chance of securing a hybrid immune to withertip, and suitable for general planting purposes in Dominica to replace the present lime, are well worth the time and patience so necessary for the successful carrying out of this kind of work.

Citrus hystrix.

In 1915 two plants of *C. hystrix* were planted out in the Experiment Station, where they have since grown into strong trees, the tallest of which has now reached a height of about 25 feet. This species is very distinct in appearance, and is armed with thick, strong, woody spines, some of which are 6 cm. or more in length. Up to the present these trees—now 7 years old—have only borne a few fruits. Compared with the lime tree, which, at the age of 7 years, usually carries a crop of from 1,000 to 3,000 fruits, whereas the best of these two specimens has so far only borne 13 fruits, this species is not likely to prove of any commercial value as a source of citric acid.

Apart from the shy bearing qualities and the comparatively low citric acid content of the fruit of *C. hystrix*, the formidable spines, which are very numerous, would no doubt be sufficient, without other drawbacks, to condemn it as a tree for general cultivation. It is probable, however, that in view of *C. hystrix* being immune to withertip—as far as inoculation experiments have been able to determine—this important quality of immunity to disease will make this tree worth while considering as a parent plant in the raising of a disease resisting strain of citrus, to take the place of the ordinary lime which is so highly susceptible to withertip. In addition to the full grown specimens a fairly large batch of seedlings have recently been raised and these will be ready for planting out at an early date.

It is hoped that it will be possible in due course to obtain the Mount Mc. Quiling form recommended in the Assistant Curator's report, and that the bearing habits of that tree will prove to be of a more prolific kind than those of the specimen now growing in the Experiment Station.

The fruits of *Citrus hystrix* have been examined with the following results:

(10 fruits examined)

Shape of fruit: Like a lemon.

Average weight: 212 grams.

„ size: 9 cm. long by 7.5 cm. across

„ thickness of rind: 6 mm.

„ no. of seeds: 18

„ juice content: 51 c.c.

„ Total acids per gallon of juice: 10.32 oz.

A sample of the juice was also forwarded to the Government Chemist, Antigua, and was reported on as follows:—

REPORT.

JUICE OF *Citrus hystrix*.

Total solids	...	...	...	8.55 per cent. Wt. /Vol.
Ash	...	...	...	0.35 per cent. Wt. /Vol.
Total acid expressed as Citric Acid				6.54 per cent. Wt. /Vol.
				10.45 ounces per gallon
True Citric Acid	...	...	...	6.54 per cent Wt. /Vol.
				10.45 ounces per gallon

The total acidity is rather low, but it seems to be entirely citric acid. The ash is somewhat high.

LEMON "VILLA FRANCA".

There are several large trees of this variety of lemon growing in the Gardens. The trees are of bushy habit and are prolific bearers. So far the trees have not shown any signs of being attacked by withertip. The fruits are medium sized and are very juicy, but the citric acid content of the juice is very low, being only 9.85 oz. per gallon.

LEMON. (UNKNOWN VARIETY).

This variety, of which there are several full grown trees in the collection, is less compact in habit of growth, and appears to be less prolific, than the "Villa Franca" variety. The citric acid content of its juice, however, is high, being 10.70 oz. per gallon, or .85 oz. per gallon more than the variety "Villa Franca".

RANGPUR LIMES.

Several young plants of the Rangpur lime have been raised from a supply of seed received from the Agricultural Department, Montserrat, and are now planted out in the Experiment Station, where they are just becoming established.

Very little is known concerning this type of lime. It appears, however, to have been introduced into Florida from Northwestern India; and Hume in his book on "Citrus Fruits and their Culture" describes the tree as being distinct in nearly all respects from the true lime. The tree is said to be immune to withertip, and possibly it may prove useful as a parent plant. Unlike the lime, the fruits do not fall readily from the tree when ripe.

**CITRUS COLLECTION AT THE BOTANIC GARDENS AND
EXPERIMENT STATION.**

The citrus collection brought together during the last 25 years comprises the following kinds:—

ORANGES

Citrus	Aurantium	"Sour" and "Sweet" oranges.
"	"	var Bigaradia. "Seville" orange.
*	"	var. Bergamia. "Bergamot" "
"	"	var. lusitana. "Portuguese" orange
"	"	var. Variegata. "Variegated ornamental" orange
"	Nobilis, var. major.	"King Mandarin"
"	"	" "Satsuma" "
"	"	"Tangerina. "Tangerine"

SWEET ORANGE VARIETIES.

Washington Navel
*"Bahia"
"Pine Apple"
"Jaffa"
*"Joppa"
*"Parson Brown"
"Florida"
"Boone's Early"
*"Heart's Tardiff"
"Ruby" (Blood)

POMELOES, SHADDOCKS AND GRAPEFRUITS.

Citrus	decumana.	Pomelo "Labuan," and Shaddock.
"	"	Grapefruit varieties.

*Not now included in Garden collection.

RESULTS OF EXPERIMENTS ON GOVERNMENT PLOT.

VARIETIES OF GRAPEFRUITS.

"Jamaica "
 "Triumph "
 "Marsh's Seedless "
 "Duncan "
 "Walters "
 "Silver Cluster "
 "Old Bahamian "
 * "Tresca "
 * "Pernambuco "
 * "Mannville's Improved."

LIMES, LEMONS, etc.,

Citrus medica. "Citron "
 " " var. acida, "Sour Lime" (Spiny type)
 " " " " (Spineless type)
 " " " Limetta, "Sweet Lime "
 " " " Limonum, "Lemon" ("Genoa" & "Villa Franca"
 kinds) *Rangpur Lime* (a kind of sour mandarin)

CITRUS HYSTRIX.

GOVERNMENT EXPERIMENT PLOT IN THE INTERIOR.

In 1903 a two acre experiment plot at Corona Estate was planted by the Agricultural Department with various kinds of citrus. Two hundred and twelve trees were planted out and the collection consisted of 12 kinds of citrus.

In starting an experiment plot at this elevation, (1600 ft.), it was hoped that the trial cultivation of the various kinds of plants would indicate the most suitable varieties for growing under the climatic conditions of the interior. For various reasons the Agricultural Department has not been able to follow up the results of this trial. Many of the trees planted, however, are still in existence and doing well, and it is hoped that it will be possible in the near future to get budwood so that some of these plants denoted in the above list by an asterisk may be re-established in these Gardens.

The present collection of citrus trees in this Department consists of 32 kinds, excluding those marked by an asterisk which in the case of the oranges are probably still at Corona, whilst the grape fruit trees have been either lost in these Gardens or rejected as poor kinds.

Efforts are now being made to add very considerably to the sour fruit class of the collection.

THE GROWING AND FLOWERING PERIODS OF THE LIME TREES AT THE EXPERIMENT STATION.

Towards the end of July 1921, an attempt was made to ascertain the period of maximum vegetative growth of the lime tree by keeping shoots under observation, and measuring their lengths once a week.

As there followed later a good deal of independent development on other parts of the trees under observation, whilst those shoots which had been marked for weekly measurements had ceased to increase in length, this method of ascertaining the period of greatest activity was found to be unsatisfactory, and was discontinued at the end of August.

Since August, the method of closely inspecting the cultivation throughout the Experiment Station once a week and noting the amount of growth and flowers present has been adopted.

The lime trees in the Experiment Station occupy an area of 22½ acres, and the ages of the trees range between 2 and 29 years.

*Not now included in the Garden Collection.

RESULTS OF EXPERIMENTS ON GOVERNMENT PLOT.

A summary of the results of the observations, which have been carried on for a period of 12 months, is given below:—

SUMMARY OF OBSERVATION.

1921-22.	Trees 2 to 5 years of age.	Trees 9 years of age.	Trees 29 years of age.
September.	Started growing vigorously during the 1st week, continued to do so throughout the month.	Inactive	Inactive.
October.	Vigorous growth continued.	"	"
November.	" "	Inactive up to the end of the month when a few growths appeared.	"
December.	" "	A few growths appeared throughout the month.	"
January.	" "	Considerable growth made during the month.	"
February.	In full growth, and those trees capable of flowering were in full bloom towards the end of the month.	Towards the end of the month the trees came into full growth and flower.	Trees started to flower freely & to grow very actively towards the end of the month.
March.	Full growth throughout the month, and flowering continued, as in the latter part of the previous month, up to the 17th when it declined.	Full growth throughout the month, and flowering continued, as in the latter part of the previous month, up to the 17th when it declined	In full growth throughout the month, & flowering continued as in the latter part of previous month, up to the 17th when it declined.
April.	Growth vigorous. A fair number of flowers about the middle of the month.	The vegetative activity of the trees fell off about the middle of the month when a fair number of flowers appeared.	The vegetative activity of the trees fell off about the middle of the month when a fair number of flowers appeared.
May.	Growth very active, and flowers fairly numerous up to the 22nd when the general activity of the trees declined.	Growth very active, and flowers fairly numerous up to the 22nd, when the general activity of the trees declined.	Growth very active, and flowers fairly numerous up to the 22nd. By the end of the month the production of shoots and flowers came to a standstill.
June.	Very little growth made during 1st two weeks. During the last 2 weeks much growth and a good many flowers were produced.	No growth. Flowered profusely during the last two weeks of the month.	No growth. Flowered profusely during the last 2 weeks of the month.
July.	Vigorous growth during first week. Fairly active throughout the rest of the month. Fair number of flowers between the 10 & 17th	Very little growth during the first 3 weeks except for a fairly active period between the 3rd & 10th. No growth during the last week.	Very little growth during the first 3 weeks except for a fairly active period between the 3rd. & 10th. No growth during the last week. A fair number of flowers were produced between the 10th & 17th.
August.	Fairly active. No flowers.	Slightly active. No flowers.	Inactive. No flowers
September.	No change worthy of note.	No change worthy of note.	No change worthy of note

From the above results it will be seen that whilst the young trees continue to grow throughout the period of observations except for a slight falling off in August and September, 1922, the full bearing trees did not commence growth, in the case of the 9 year old trees, before November, and in the case of those of 20 years of age before February. On the whole February and March may be regarded as the first period of greatest activity for trees of all ages. Another period of great activity occurs about May and June.

Generally speaking, the growing period for trees of all ages commences about the middle of January, and continues on to the end of July, with February-March and May-June as the periods of greatest activity in respect of both flowers and shoots.

It would appear from recent observations in the Experiment Station that the length of time required for a fruit to mature, from the time the flower bud opens to the time when the fruit is ripe and falls from the tree, is 159 days, or approximately $5\frac{1}{2}$ months.

Considering that the first crop of fruit at the Experiment Station generally reaches the maximum about August, and the second about November, and taking into account that $5\frac{1}{2}$ months are required for a lime fruit to come to maturity from the flower stage, it is probable that these periods, February-March, and May-June, are more or less regular every year.

Though the above periods are more or less regular, judging by the regularity of the period of maximum crops, slight variations must occur occasionally, when the crops reach their respective heights in September and December, instead of August and November. It is probable that these variations are largely due to weather conditions, which, when very wet retard the ripening of the fruits, and impose on the trees a strain from which they must first sufficiently recover before they are able to put forth fresh flowers and growths.

The effects of weather conditions on the ripening of the lime crops are more noticeable in the wet districts—especially at elevations above 1,000 feet—where the crops come in much later than those on the coast lands.

The time of applying manures, and the kinds of manures used, also affects to a certain extent the growing period of the tree, and the ripening of the fruit.

It would have been more satisfactory, had time permitted, to have continued these observations for a further period of, say, 3 months, so as to allow of a fair overlapping of the 12 months period. These results, however, are sufficiently accurate to supply certain information which it has been desirable to obtain as a first step in the proper study of "Die back"—a condition commonly met with in lime, and also cacao cultivations in certain situations in Dominica—and it is probable that those who contemplate spraying for the control of withertip may also find it useful to have at hand some definite information concerning the growing and flowering periods of the lime trees; since spraying operations can only give satisfactory results by carrying out the work just before and during the seasons of greatest activity.

ABNORMAL FLOWERS OF THE SPINELESS LIME.

When first brought to the notice of planters some years ago after its discovery on Shawford Estate, the spineless lime was regarded as a desirable tree to grow, and fairly large numbers of plants were planted on several estates throughout the island. Soon, however, the tree proved itself to be a shy bearer, and as the nonprolific nature of the tree outweighed its good qualities, the principal of which was its spineless habit, the demand for this variety gradually fell off, and ceased altogether a few years ago.

Soon after withertip made its appearance in the Experiment Station, the spineless lime trees were observed to be more severely attacked than the ordinary seedling lime. On closely inspecting the flowers of these trees it was found that, while

THE SPINELESS LIME.

many were badly affected by withertip, a large number of others were turning brown and falling from the trees on account of their faulty structure, which prevented them from setting fruit.

The shedding of flowers having the same brown appearance as those attacked by blossom blight, and yet not affected by the disease, is undoubtedly due to the aborted and partially aborted stigmas, for on examination of such flowers these defects were apparent in all.

Since the number of flowers of imperfect structure may be safely estimated at 50 per cent of the total number produced by a tree, it is not surprising that this variety should have been rejected as being less prolific than the ordinary type.

In those flowers which are completely aborted there is but a mere rudimentary stigma to be found hidden below the stamens; whilst in the partially aborted flowers the length of the stigma is out of all proportion to the lengths of the stamens and petals, in some cases being of such a length as to protrude from the flower bud, which it appears to force open prematurely, and in other cases so short as to reach not higher up between the stamens than half way.

Investigational and other work in connection with withertip has made it impossible to devote the time necessary for making observations over a more extended period, and a larger number of trees; but it is hoped that the results given below will be sufficient for the present to show the cause for the non-prolific habit of the spineless lime.

FLOWERS KEPT UNDER OBSERVATION.

			No. of each kind under obser- vation.	No. of each kind that fell.	No. of each kind that set fruit.
Perfect flowers	...	...	14	1	13
Partially aborted	...	...	30	28	2
Completely aborted	...	...	30	30	nil
Totals	...	...	74	59	15

From casual observations made in the Experiment Station, the ordinary lime has also been found to produce imperfect flowers, all of which so far as it has been possible to ascertain, are of the completely aborted kind. On some trees imperfect flowers are more numerous than on others, and this irregular distribution of imperfect flowers is noticeable also on the various branches of individual trees: some branches producing many imperfect flowers, whilst others produce few, or none at all.

Further observations will be made on the numbers and distribution of abnormal flowers over individual trees. Where trees are found producing perfect flowers only, it should be possible, by selecting bud wood from these, to bud out this abnormality with the successful results such as have been obtained by propagators and plant breeders in their work of budding and selecting for the elimination of spines and seeds.

SPLITTING OF LIME FRUITS.

During August lime fruits affected as stated above were quite noticeable in the Experiment Station. Later a few oranges at the Botanic Gardens were found

BUDDING OF PLANTS.

in a similar condition. About this time a number of ruptured limes were noticed on an adjoining estate, and some of these fruits were brought to the Botanic Gardens for inspection by the agricultural officers.

As this condition occurred on clean skinned limes produced on trees quite free from scale insects and other pests, a number of affected fruits were despatched to the Head office, Trinidad, for examination.

It was then learned that the cause of the splitting of the rind of citrus fruits in Florida is attributed in the first place to the hardening of the skin due to a period of drought. Should good growing weather follow, the fruit, owing to internal pressure is in some instances liable to rupture. As the first named weather condition did not occur in Dominica in a pronounced form during the growing season, further observations were necessary. It was then found that the rind of the fruit, had in each instance, given way where the presence of a small or large scab, as the case may be, showed the point of attack by withertip disease.

In this connexion it should be pointed out that while withertip fungus attacks the flowers and fruits and destroys many, especially in the wet districts, a considerable number of the latter, though attacked, are able to develop. Such fruits are usually marked as stated above, and these spots form points of weakness in the rind.

While this matter is of no particular importance at present it is now probable that split fruits, especially after a period of dry weather, will be more noticeable in future owing to the new condition which has recently arisen.

A SIMPLE FORM OF BUDDING.

A method of budding which is practised with very successful results at the Foreign Seed and Plant Introduction Garden, Miami, Florida, and also by Mango and Avocado growers in that locality, is one well worth following in Dominica.

Since this method gives quicker results, and is more simple of accomplishment than the usual method employed in this island, directions for the carrying out of this form of budding are here given.

For insertion into the stock, a semi-matured shoot from 2 to 2½ inches long, and with a plump bud as its apex, is chosen. The shoot, which should not be thicker than a lead pencil, (or thinner where the thickness of the stock employed is less than ½ an inch in diameter), is prepared by first carefully cutting away the leaves. Then with a sharp knife commencing the cut immediately under the base of the terminal bud, a diagonal cut is made extending from the bud to the base of the shoot. When prepared the shoot should have one of its sides intact, whilst the other will be cut away in such a manner as to give it a wedge-shaped appearance.

In regard to the stock, the best results are obtained with those not exceeding ½ an inch in diameter. Provided however that the part of the stock selected for budding is not too old, and that the bark parts readily from the wood—a necessary condition in all parts to be budded, regardless of their diameters—the thickness of the stock is not a matter of very great importance.

The stock is prepared by making incisions in the bark like the letter T with a long tail, the length of tail, or vertical incision, being made slightly shorter than the length of a shoot to be inserted.

In order that the plump terminal bud may fit in close to the stem of the stock, a piece of bark, and if necessary a piece of wood as well, is cut away immediately above, and over the centre of the horizontal incision.

Having prepared the stock and scion, the latter is inserted at the top of the vertical incision and gently pushed down until the bud fits snugly into the place prepared for it.

LIME EXPERIMENT STATION REPORT.

By making the vertical incision in the stock slightly shorter than the length of the shoot, there should be no difficulty in getting a snug fit, for if the bark is in the right condition, a sufficient lengthening of the cut will take place as the shoot is pushed into position. Once the shoot is slipped into its place, a piece of bast, worsted, or narrow tape should be firmly wound once or twice round the stock, so that the two flaps of the T incision are held securely over the shoot.

A piece of water proof paper, (oblong in shape), is then tied on to the budded stem to give protection from sun and rain, the paper being wrapped closely round the stem above the shoot, and there tied; whilst the lower edge of the paper is allowed to remain unfastened so as to hang out from the stem, and thus afford a cone-like covering to the shoot beneath.

With the paper fastened into position the operation is complete, and in about 20 days a perfect union should be effected.

Report on the Lime Experiment Station, Dominica.

This Station was started in April 1913, and the first planting of limes was made in July of the same year. A statement showing the expenditure and receipts during the ten year period is given below:—

					Expenditure.			Receipts.		
					£.	s.	d.	£.	s.	d.
1913-14	---	---	...	...	50	0	0	17	9	7
1914-15	---	---	...	...	70	0	0	61	1	5
1915-16	...	---	...	...	120	0	0	86	9	10
1916-17	---	...	...	...	175	0	0	121	2	11
1917-18	...	...	...	...	175	0	0	180	12	2
1918-19	...	...	...	...	200	0	0	233	12	8
1919-20	...	...	...	...	250	0	0	625	6	7
1920-21	---	...	...	...	320	0	0	741	8	2
1921-22	...	...	...	...	400	0	0	456	8	3
1922-23	...	...	...	...	350	0	0	423	1	2
Cost of manures to date	...	...	...	...	220	0	0			
Cost of drainage (from Special Services Grant)	...	...	...	...	48	3	0			
Head labourer's house	...	...	...	...	60	0	0			
Shed for housing mill, etc.	...	...	...	...	100	0	0			
					£ 2538	3	0	£ 2946	12	9

Supervision, always a considerable charge, has cost nothing in this instance, the work having been done by the agricultural officers. A fair amount of assistance has also been given by the two or three agricultural pupils who have been under training during recent years. These were from time to time engaged in sowing green dressings, applying manures, pruning trees, and other work of a light character.

It should be clearly understood that the figures of expenditure given above not only maintain the present bearing area of limes, which includes the gathering and transport of the crop to the Bath Estate, but also covers the cost of upkeep of about 10 acres of young lime cultivation, 8 acres of young coconuts, and a further area of 2 areas consisting of plots of grapefruits, camphor, etc.

During the nine years of its existence the Experiment Station, so far as the disposal of the crop is concerned, has been in the position of a small grower, that

LIME EXPERIMENT STATION REPORT.

is, the ripe and green limes have had to be sold in the open market at the current ruling prices. For purposes of record, a table has been prepared which shows the local market rates per barrel of fruit since 1914-15 :—

RIPE LIMES.

Year.	Barrels of fruit.	Amount received.	Rate per barrel.
		£ s. d.	£ s. d.
1914-15	222	61 1 5	5 6
1915-16	315	86 9 10	5 6
1916-17	541	121 1 1	4 5½
1917-18	649	180 12 2	5 6¾
1918-19	1,070	221 2 8	4 1½
1919-20	1,589	498 1 6	6 5½
1920-21	2,571	688 17 4	5 4½
1921-22	2,485	456 8 3	3 8
1922-23	2,916	423 1 2	2 10¾

GREEN LIMES.

Year.	Barrels of fruit.	Amount received.	Rate per barrel.
		£ s. d.	£ s. d.
1918-19	10	12 10 0	1 5 0
1919-20	191	127 5 1	13 3¼
1920-21	55½	52 10 10	18 11
1921-22	—	—	—
1922-23	—	—	—

The total crop for the year was 2,916½ barrels of limes, all of which were sold in the local market, and realized £423 1. 2. This gives an average return of 2s. 10¾d. per barrel.

MANURIAL EXPERIMENTS WITH LIMES.

The main manurial experiments now carried on consist of five plots, three times repeated, two series with young limes, and one series with old limes. They are as follows :—

- A. Complete manure of nitrogen, phosphates and potash.
- B. Control. No manure.
- C. Mulch of grass, 5 tons per acre.
- D. Nitrogen and phosphates.
- E. Nitrogen and potash.

In each case the nitrogen was originally applied in the form of Swift's manure, 8 per cent ammonia, at the rate of 4 cwt. per acre, but during the past three years, this manure could not be obtained, and the equivalent in the form of cotton seed meal was applied instead.

MANURIAL EXPERIMENTS WITH LIMES.

The mulch applied is mainly in the form of lemon grass, supplemented by leaves and young shoots of *Gliricidia maculata*. Both forms of mulch are specially grown on what would otherwise be waste grounds in the vicinity of the plots. This system of utilizing odd corners, steep hillsides, and the banks of streams for growing material for application to cultivated areas is strongly recommended in Dominica.

The phosphatic requirements of the plots are furnished in the form of basic slag, applied at the rate of 4 cwt. per acre, and the potash, by sulphate of potash at $1\frac{1}{2}$ cwt. per acre. During 1920-21 neither of these manures could be obtained, and the falling away of crop during 1921-22 is in some measure due to the lack of these fertilizers. During the year under review sulphate of potash was again available, and as basic slag could not be got, 16 per cent acid phosphate was used in its place.

The yields of these plots, in barrels of fruit, during the period 1917-18 and 1922-23 are given below:—

SIX YEARS' RESULTS OF MANURIAL EXPERIMENTS WITH LIMES.

ORIGINAL SERIES.

Trees planted July, 1913,

Year.	Size of plots.	A.		B.		C.		D.		E.	
		Complete manure.		Control.		Mulch.		Nitrogen and phosphates.		Nitrogen and potash.	
		per plot.	per acre.	per plot.	per acre.	per plot.	per acre.	per plot.	per acre.	per plot.	per acre.
1917-18	$\frac{1}{4}$ -Acre	$15\frac{3}{4}$	63	14	56	$23\frac{3}{4}$	95	$23\frac{3}{4}$	95	$7\frac{3}{4}$	31
1918-19	"	60	240	$45\frac{3}{4}$	183	$71\frac{3}{4}$	287	$58\frac{1}{2}$	234	$34\frac{3}{4}$	139
1919-20	"	85	340	$89\frac{1}{2}$	358	$99\frac{1}{2}$	398	$88\frac{1}{2}$	354	$60\frac{1}{2}$	242
*1920-21	"	$118\frac{3}{4}$	475	$109\frac{1}{4}$	437	$130\frac{1}{2}$	522	$117\frac{1}{2}$	470	112	448
1921-22	"	95	380	$85\frac{3}{4}$	343	99	396	$85\frac{3}{4}$	343	86	344
1922-23	"	88	352	$68\frac{1}{2}$	274	$95\frac{1}{2}$	382	$81\frac{1}{2}$	326	$90\frac{1}{2}$	362

DUPLICATE SERIES.

Trees planted July 1913.

Year.	Size of plots.	A.		B.		C.		D.		E.	
		Complete manure.		Control.		Mulch.		Nitrogen and phosphates.		Nitrogen and potash.	
		per plot.	per acre.	per plot.	per acre.	per plot.	per acre.	per plot.	per acre.	per plot.	per plot.
1917-18	$\frac{1}{4}$ -Acre	$6\frac{3}{4}$	27	$10\frac{1}{4}$	41	18	72	$6\frac{3}{4}$	27	$10\frac{3}{4}$	43
1918-19	"	$34\frac{3}{4}$	139	$22\frac{1}{2}$	90	$42\frac{1}{4}$	169	30	120	$38\frac{1}{2}$	154
1919-20	"	$57\frac{3}{4}$	231	38	152	$69\frac{3}{4}$	279	$60\frac{1}{2}$	242	$72\frac{1}{2}$	290
*1920-21	"	117	468	$81\frac{1}{2}$	326	$115\frac{1}{2}$	462	$105\frac{3}{4}$	423	$115\frac{3}{4}$	463
1921-22	"	79	316	$52\frac{1}{4}$	209	$85\frac{1}{2}$	342	81	324	94	376
1922-23	"	77	308	45	180	80	320	82	328	97	388

*No P'osphates or Potash applied that year.

MANURIAL EXPERIMENTS WITH LIMES.

TRIPPLICATE SERIES.

Old Trees planted 1893.

Year.	Size of plots.	A.		B.		C.		D.		E.	
		Complete manure.		Control.		Mulch.		Nitrogen and phosphates.		Nitrogen and potash.	
		per plot.	per acre.	per plot.	per acre.	per plot.	per acre.	per plot.	per acre.	per plot.	per acre.
1917-18	$\frac{1}{4}$ acre	45	180	$29\frac{3}{4}$	119	$25\frac{1}{2}$	102	$27\frac{1}{2}$	110	$22\frac{3}{4}$	91
1918-19	"	70	280	$32\frac{1}{2}$	130	23	92	$52\frac{1}{2}$	210	$34\frac{1}{2}$	138
1919-20	"	$89\frac{3}{4}$	359	$48\frac{1}{2}$	191	32	128	$67\frac{1}{4}$	269	50	200
1920-21	"	$85\frac{1}{4}$	341	$52\frac{1}{2}$	210	$13\frac{1}{2}$	175	97	388	$64\frac{3}{4}$	259
1921-22	"	74	296	$42\frac{1}{2}$	170	40	160	79	316	$7\frac{3}{4}$	295
1922-23	"	69	276	34	136	37	148	86	344	70	280

It would be unwise to attempt to draw any definite conclusions in orchard cultivation from the results of a series of plots on a six years term of manurial experiments, but this need not prevent consideration of yields of the plots collectively. The ten plots of young limes, which cover an area of $2\frac{1}{2}$ acres, were planted in July 1913, and are therefore, at the end of March 1923, nine years and nine months old from the time of being placed out in the field. The crop returns during this period are as follows:—

1917-18	5th year	...	$143\frac{3}{4}$	barrels	or	57	barrels per acre.
1918-19	6th "	...	$438\frac{3}{4}$	"	"	175	" " "
1919-20	7th "	...	719	"	"	228	" " "
1920-21	8th "	...	1,124	"	"	450	" " "
1921-22	9th "	...	$844\frac{1}{2}$	"	"	338	" " "
1922-23	10th "	...	805	"	"	322	" " "

These results are especially remarkable in view of the fact that only $\frac{1}{2}$ acre of the $2\frac{1}{2}$ acres receives a complete concentrated manure, and whilst one acre in this area receives an incomplete manure and $\frac{1}{2}$ acre an application of mulch—a complete, but slow acting manure—the remaining $\frac{1}{2}$ acre receives no manurial treatment at all.

A better idea of the effects of the various manures and cultural measures carried on, may be gained from the table below, in which the plots, each receiving identical treatment in the three series of experiments, are grouped together. This table shows at a glance the actual yield per three plots of a kind grouped together, the calculated yield per acre, and the increase, or decrease per acre, per annum, compared with the previous year.

*No Phosphates or Potash applied that year.

MANURIAL EXPERIMENTS WITH LIMES.

3 COMPLETE MANURE PLOTS. ($\frac{1}{4}$ ACRE EACH.)

Year.	Area.	Yield in Barrels Per $\frac{3}{4}$ Acre.	Calculated yield in Barrels per Acre.	Increase or decrease per Acre compared with previous year.
1917-18	$\frac{3}{4}$ Acre	67 $\frac{1}{2}$	90	+
1918-19	"	164 $\frac{3}{4}$	219 $\frac{2}{3}$	+ 129 $\frac{2}{3}$
1919-20	"	232 $\frac{1}{2}$	310	+ 90 $\frac{1}{3}$
*1920-21	"	321	428	+ 118
1921-22	"	248	330 $\frac{2}{3}$	- 97 $\frac{1}{3}$
1922-23	"	234	312	- 18 $\frac{2}{3}$
		1,267 $\frac{3}{4}$	= Total yield for 6 years.	

3 CONTROL PLOTS. ($\frac{1}{4}$ ACRE EACH.)

Year.	Area.	Yield in Barrels per $\frac{3}{4}$ Acre.	Calculated yield in Barrels per Acre.	Increase or decrease per Acre compared with previous year.
1917-18	$\frac{3}{4}$ Acre.	54	72	
1918-19	"	100 $\frac{3}{4}$	134 $\frac{1}{3}$	+ 62 $\frac{1}{3}$
1919-20	"	176	234 $\frac{2}{3}$	+ 100 $\frac{1}{3}$
1920-21	"	243 $\frac{1}{4}$	324 $\frac{1}{3}$	+ 89 $\frac{2}{3}$
1921-22	"	180 $\frac{1}{4}$	240 $\frac{1}{3}$	- 84
1922-23	"	147	196	- 44 $\frac{1}{3}$
		901 $\frac{1}{4}$	= Total yield for 6 years.	

3 MULCH PLOTS ($\frac{1}{4}$ ACRE EACH.)

Year.	Acre.	Yield in Barrels Per $\frac{3}{4}$ Acre.	Calculated yield in Barrels Per Acre.	Increase or decrease per Acre compared with previous year.
1917-18	$\frac{3}{4}$ Acre.	67 $\frac{1}{4}$	89 $\frac{2}{3}$	
1918-19	"	138	184	+ 94 $\frac{1}{3}$
1919-20	"	201 $\frac{1}{4}$	268 $\frac{1}{3}$	+ 84 $\frac{1}{3}$
1920-21	"	289 $\frac{3}{4}$	386	+ 117 $\frac{2}{3}$
1921-22	"	224 $\frac{1}{2}$	299 $\frac{1}{3}$	- 86 $\frac{2}{3}$
1922-23	"	212	282 $\frac{2}{3}$	- 16 $\frac{2}{3}$
		1,132 $\frac{3}{4}$	= Total yield for 6 years	

*No Phosphates or Potash applied that year.

MANURIAL EXPERIMENTS WITH LIMES.

3 NITROGEN AND PHOSPHATES PLOTS ($\frac{1}{4}$ ACRE EACH.)

Year.	Acre.	Yield in Barrels Per $\frac{3}{4}$ Acre.	Calculated yield in Barrels per Acre.	Increase or decrease per Acre compared with previous year.
1917-18	$\frac{3}{4}$ Acre.	64 $\frac{3}{4}$	86 $\frac{1}{3}$	
1918-19	"	141	188	+ 101 $\frac{2}{3}$
1919-20	"	216 $\frac{1}{4}$	288 $\frac{1}{3}$	+ 100 $\frac{1}{3}$
1920-21	"	320 $\frac{1}{4}$	427	+ 138 $\frac{2}{3}$
*1921-22	"	240 $\frac{1}{2}$	320 $\frac{2}{3}$	- 160 $\frac{2}{3}$
1922-23	"	250	333 $\frac{1}{3}$	+ 12 $\frac{2}{3}$
		1,232 $\frac{3}{4}$	= Total yield for 6 years.	

3 NITROGEN & POTASH PLOTS. ($\frac{1}{4}$ ACRES EACH.)

Year.	Acre.	Yield in Barrels Per $\frac{3}{4}$ Acre.	Calculated yield in Barrels per Acre.	Increase or decrease per Acre compared with previous year.
1917-18	$\frac{3}{4}$ Acre.	41 $\frac{1}{4}$	55	
1918-19	"	107 $\frac{3}{4}$	134 $\frac{2}{3}$	+ 88 $\frac{2}{3}$
1919-20	"	183	244	+ 100 $\frac{1}{3}$
*1920-21	"	292 $\frac{1}{2}$	390	+ 146
1921-22	"	253 $\frac{3}{4}$	338 $\frac{1}{3}$	- 51 $\frac{2}{3}$
1922-23	"	257	342 $\frac{2}{3}$	+ 3 $\frac{2}{3}$
		1,135 $\frac{1}{4}$	= Total yield for 6 years.	

It will be observed from the table that a general falling off in the yield has occurred during the past two years, but the returns, compared with the average yield of lime fields, are still very high. The experiments so far, show what can be accomplished under average conditions during the first ten years, if the cultural and manurial requirements of the trees are attended to. Had the whole area of 2 $\frac{1}{2}$ acres received a complete concentrated manure, the returns would have been higher than those shown in the table.

Judging by Dominica standards, all the plots, including those receiving no manure have done well. In the latter instance the influence of good cultural measures, apart from the application of manures, must be evident to all who study the table of crop returns.

The mulched plots although not giving the highest return, are of special interest to lime growers. As is well known this material is without the forcing effect of concentrated fertilizers, but it is cumulative in its effects. It is practically certain that the standard of health of the lime tree is higher in the mulched than in any of the plots receiving concentrated manures only. This material which is so abundant in the island, should be the chief manure used by cultivators. To the present however, only a few planters have realised its great value in agriculture.

*No Phosphates or Potash applied that year.

BUDDING EXPERIMENTS.

Owing to the fluctuating prices, it is not possible to state with any accuracy the cost of applying a complete manure per acre, but if we assume the amount to be in the vicinity of £6, we find by taking the average value of a barrel of limes at 5s., that an increase in crop per acre of about 24 barrels is sufficient to cover the cost of the application. It will be seen from the results of the experiments shown in the table above that the application of a complete concentrated manure has not only paid, but yielded a considerable profit in addition.

OTHER MANURIAL EXPERIMENT PLOTS.

Both seedling and spineless limes budded on sour orange stocks, and ordinary seedlings, have been under experiment since 1914, and occupy one acre of land.

The acre is divided up into $\frac{1}{4}$ acre plots as follows: two plots of common limes budded on sour orange stocks; one plot of spineless limes on the same kind of stocks; and one plot of ordinary seedling limes for comparison.

During 1917-18 and 1918-19 the trees in each plot have received a small dressing of organic nitrogen at the rate of 4 cwt. per acre. During the first three years of their existence, No. 1 budded plot, (see table below), was grown with Tephrosia as a green dressing, whilst No. 2 budded plot was grown in the usual way with weeds and grass, which was occasionally weeded. The spineless limes had green dressings of horse beans, and the seedling limes were clean weeded. Early in 1919-20 each plot received a complete manure of nitrogen, phosphates and potash. It is intended to maintain this series as complete manure plots. The crop yields of the four plots since fruiting commenced are as follows:—

SIX YEARS' RESULTS OF EXPERIMENTS CONDUCTED WITH SPINELESS AND COMMON LIMES, BUDDED ON SOUR ORANGE STOCKS, AND WITH COMMON SEEDLING LIMES.
PLANTED JULY 1914.

SPINELESS LIMES BUDDED ON SOUR ORANGE STOCKS.

Year.	Size of Plot.	Actual yield in barrels per plot.	Calculated yield in barrels per acre.
1917-18	$\frac{1}{4}$ acre	$6\frac{1}{2}$	26
1918-19	"	$18\frac{1}{4}$	73
1919-20	"	34	136
*1920-21	"	46	184
1921-22	"	$45\frac{1}{2}$	182
1922-23	"	62	248

COMMON LIMES BUDDED ON SOUR ORANGE STOCKS. (PLOT I.)

Year.	Size of plot.	Actual yield in barrels per plot.	Calculated yield in barrels per acre.
1917-18	$\frac{1}{4}$ acre	8	32
1918-19	"	$34\frac{3}{4}$	139
1919-20	"	$39\frac{3}{4}$	159
*1920- 1	"	$98\frac{1}{2}$	394
1921-22	"	$91\frac{3}{4}$	367
1922-23	"	132	528

*No Phosphates or Potash applied that year.

BUDDING EXPERIMENTS.

COMMON LIMES BUDDED ON SOUR ORANGE STOCKS (PLOT 2)

Year.	Size of Plot	Actual yield in barrels per plot.	Calculated yield in barrels per acre.
1917-18	$\frac{1}{4}$ acre	6	24
1918-19	"	$13\frac{3}{4}$	55
1919-20	"	$31\frac{1}{4}$	125
*1920-21	"	86	344
1921-22	"	$73\frac{3}{4}$	295
1922-23	"	121	484

COMMON SEEDLING LIMES

Year.	Size of plot.	Actual yield in barrels per plot	Calculated yield in barrels per acre.
1917-18	$\frac{1}{4}$ acre	Nil	Nil
1918-19	"	$16\frac{3}{4}$	67
1919-20	"	$22\frac{3}{4}$	91
*1920-21	"	61	244
1921-22	"	58	232
1922-23	"	$64\frac{1}{2}$	258

The returns from the four plots (or 1 acre), since bearing commenced, are as follows :—

1917-18	4th. year	...	$20\frac{1}{2}$	barrels	of	limes
1918-19	5th "	...	$83\frac{1}{2}$	"	"	"
1919-20	6th "	...	$127\frac{3}{4}$	"	"	"
1920-21	7th "	...	$291\frac{1}{2}$	"	"	"
1921-22	8th "	...	269	"	"	"
1922-23	9th "	...	379	"	"	"

In this particular experiment the budded plants have done better than seedling limes, but whether the lead will be maintained is a matter which future work will be able to determine.

NEWLY STARTED MANURIAL EXPERIMENT PLOTS.

Three new series, each consisting of three plots, were started early in 1921. The treatment given in the first series is repeated three times. The plots are numbered 16 to 24.

The treatment given is as follows :—

Series I.	Plot 16.	Ready mixed complete fertilizer, (8 per cent. nitrogen, 10 per cent. phosphates and 4 per cent. potash), at the rate of 500 lb. per acre (with mulch - $2\frac{1}{2}$ tons per acre).
	Plot 17.	Control. (No fertilizer or mulch.).
	Plot 18.	Ready mixed complete fertilizer, (8 per cent. nitrogen, 10 per cent. phosphates, 4 per cent. potash) at the rate of 1,000 lb. per acre (with mulch - $2\frac{1}{2}$ tons per acre).

* No Phosphates or Potash applied that year.

The addition of nine plots brings the number of experiment plots now being conducted at the Station, up to thirty. The twenty one plots running before the new experiments were started involved no less than 1,809 separate measurements and records, an average of eighty six pickings per plot. With the addition of three new series this work connected with measuring and recording will be greatly increased involving as it will close on 2,600 measurements each year. What this means can be understood only by those who carry on the work. The need of so much recording is the chief reason why so few experiments are made on lime estates; owners, managers, and overseers alike finding it very difficult to keep accurate returns of the crop, which under good cultivation is coming in over eight months of the year, and practically all the year round in the case of well manured young limes.

To carry on a series of plot experiments with limes is difficult and exacting. Similar plot work in connexion with sugar, cotton, and even with cacao, appears to be very easy when compared with the requirements, as regards crop records, of the lime tree under experimental cultivation.

GENERAL REMARKS.

During the early part of 1922, one acre of rather steep land, which had been cleared, drained, and holed, during the previous year, was planted with limes. These were spaced at 10 feet apart in the rows and 20 feet apart between the rows. It is of course necessary in an Experiment Station to demonstrate various ideas in regard to planting, and this, which may be termed the hedge system, is one worthy of attention and trial. Under certain conditions in Dominica it may prove to be a desirable form of cultivating these trees. It should, however, be pointed out that if this method is followed on level or undulating lands at least 25 or 30 feet ought to be allowed between the rows.

In former reports several references were made to the experiment of budding limes on citron, M'gergeb, and sour orange stocks. The two first named proved to be failures, but the sour orange has shown itself to be excellent for this purpose. The first attempts in this line of work were made during 1914, when $\frac{1}{2}$ acre of the common lime, (56 plants) and $\frac{1}{4}$ acre of the spineless lime, (28 plants) were placed out. These are to-day the best trees in the Experiment Station. After the hurricanes of 1915 and 1916, a further planting of sixty budded trees was made on an area on which the seedling limes had been almost completely destroyed by the force of the wind.

These early attempts to use the sour orange as a stock were due to the great injury caused to seedling lime trees during hurricanes. It is well-known to observant planters that the sour orange tree is but rarely uprooted during such occurrences, and it was felt that the lime would be much more secure, and consequently of greater value to the planter, if it were found to succeed upon this stock. This practical immunity from over-turning is due partly to the tap root and partly to the exceedingly strong lateral root system which is such a feature in both the sweet and sour oranges. In the lime there is no tap root and the laterals are few and weak in comparison with those of the oranges named.

Experimental work has already shown that budded limes form excellent bearing trees, but the behaviour of such plants when subjected to violent winds has still to be demonstrated. Should the roots stand firm under such an ordeal the superiority of budded over seedling limes will have become established. It is, of course, understood that during high winds the tops of such trees may suffer and many branches may be broken, but recovery from this form of injury is rapid when the root system remains uninjured, and it is in no way so serious as the damage and retardation of growth and cropping which follows the overturning of seedling trees.

Recent investigations tend to show that a further advantage may follow the use of the sour orange as a stock for limes. During the year under review several tests of the juices of fruit from both seedling and budded limes have been carried

on, and in all cases the juice of the fruits from budded limes has shown a considerable higher acid content over that yielded by seedling trees. In these cases both kinds of trees are growing under the same conditions in the same field and both receive exactly the same cultural and manurial treatment. The mean of the several tests showed an advantage in favour of the budded trees of $1\frac{1}{2}$ oz. of citric acid per gallon of juice, while the yield of juice was distinctly higher in the case of budded limes.

Should further investigations show this advantage to be definite and permanent in limes budded on the sour orange, it will be possible for planters to increase the citric acid production per acre very considerably by using these stocks. Under such conditions the higher cost of the latter over seedling limes would be considered a sound investment, having in view the several potential advantages, and not, as now, regarded as a prohibitive charge. At present the cost of seedling plants for an acre of land, spaced at 20 feet apart, including a certain number for filling vacancies, is 5s. For budded plants and making no allowance for vacancies, the cost is £3 15s 0d.

If continued observations show that the citric acid content of lime juice can be increased by only 1 oz. per gallon, the result would, on an estate making an average annual crop of 10,000 barrels of fruit mean an additional 5,000lb. of citric acid to the yearly crop. Such an increase in the annual yield on a well kept estate over the life-time of the plantation would prove a very handsome return and fully justify the use of budded plants for this reason alone.

There can be no doubt that the application of budding and grafting, in the case of tropical productions, has been largely extended during recent times. Less than a generation ago this work was carried on chiefly in connexion with fruit trees and then only in a limited way. During recent years great advances have been made, and the time appears to be approaching when this treatment will be applied to many tropical economic plants. To the present, however, very little attention appears to have been given in the tropics to the matter of stocks and their possible effect on the tree and its product. The good qualities of the scion are usually well known, but as far as the stock is concerned, the work may be said to be carried on indiscriminately.

Investigations on these lines are certainly required. If it should be found that budding or grafting on stocks containing but little of the products for which the tree is grown leads to greater increases of certain products in the upper part of the trees, then another strong reason for the more general adoption of asexual propagation of economic plants would be found. Incidentally this also shows the large amount of work in various directions which awaits investigation at the hands of officials of Tropical Agricultural Departments.

Report on Manurial Experiments with Cacao in Dominica, 1921 and 1922.

Full accounts of these experiments, which were first stated in 1902, have appeared in previous reports on the Agricultural Department, Dominica. In the present report it is intended to present only the general conclusions arrived at, together with the statistical results for the two years under review.

Up to 1921-22, there have been two series of experiments, the main series in which the effects of (i) phosphate and potash, (ii) dried blood (iii) dried blood, phosphates and potash and (IV) mulch of grass and leaves were tried respectively; and an additional series, started in 1907-8, in which were tried the respective effects of i) mulch and (ii) cotton-seed meal.

The results per acre for the last two years were:—

MAIN SERIES.

1920-21	Control.	I.	II.	III.	IV.
Wet cacao	2,136	2,889	2,539	3,414	3,173
Cured cacao	897	1,213	1,066	1,434	1,383
1921-22					
Wet cacao	2,232	2,793	2,639	3,462	3,769
Cured cacao	937	1,173	1,108	1,454	1,583

ADDITIONAL SERIES.

1920-21.	Mulched.	Cotton Seed Meal.	No Manure.	Mulched.
Wet cacao	4,052	3,032	1,787	2,761
Cured cacao	1,702	1,273	750	1,159
1921-22.				
Wet cacao	3,964	3,048	1,210	2,745
Cured cacao	1,664	1,280	508	1,153

AVERAGE ANNUAL RETURN FOR TWENTY YEARS.

The following supplementary table gives the average annual return of wet and dried cacao in pounds for twenty years in the case of the first five plots, and for

MANURIAL EXPERIMENTS WITH CACAO.

fifteen years in the case of plot 6 to 9. The last column shows the percentage increase of each plot over the no manure plot :—

No.	Manurial treatment.	Wet Cacao.		Cured Cacao per acre.	Increase over No-manure plot per cent.
		per plot.	per acre.		
Average for 20 years.					
1	No manure	746	2,664	1,119	
2	Phosphate & Potash ...	971	3,348	1,406	25·6
3	Dried blood	1,170	3,250	1,365	21·9
4	Dried blood, phosphate and potash ..	1,114	3,841	1,613	44·1
5	Mulched with grass and leaves	1,527	4,127	1,733	54·8
Average for 15 years.					
6	Mulched with grass and leaves	1,196	4,784	2,009	141·1
7	Cotton seed-meal	958	3,832	1,609	93·1
8	No manure	821	1,983	833	
9	Mulched with grass and leaves	1,336	3,582	1,504	80·5

In former reports the pecuniary aspect of the experiments was shown in one table for the year under review, and in another for the whole period of the experiments, but in these times of high rates for manures, prohibitive in some instances, and fluctuating prices for cacao, such tabulations convey little in the way of reliable information. To those planters who are interested, the above table showing percentage increases over no-manure plots, will afford facts for consideration and future guidance.

CACAO EXPERIMENTS.

NEW SERIES.

The old experiments, the crop records of which have been carefully kept for a period of twenty years in the case of five plots and for fifteen years in respect to four plots, have been brought to a close, and a new series, as described below, commenced on July 1, 1922. In the new experiments the ten plots fall naturally into four sections as regards soil and situation, therefore the plots within the various groups are comparable with each other. The first seven plots are on level land ; the three others are situated on a hillside.

MANURIAL EXPERIMENTS WITH CACAO—NEW SERIES.

Plot number.	Area, acres.	Previous treatment per acre.	Proposed treatment per acre.	
1	0.28	No manure	450 lb. nitrapo 450 lb. basic slag	} with mulch
2	0.29	448 lb. basic slag 168 lb. sulphate of potash	900 lb. mixed fertilizer (8-10-4)	} without mulch
3	0.36	448 lb. dried blood	450 lb. nitrapo 450 lb. basic slag	} without mulch
4	0.29	448 lb. dried blood 448 lb. basic slag 168 lb. sulphate of potash	900 lb. mixed fertilizer (8-10-4)	} 5 tons mulch
5	0.37	5 tons mulch	5 tons mulch	
6	0.25	4 tons mulch	300 lb. nitrapo 400 lb. basic slag	} with mulch
7	0.25	600 lb. cotton-seed	600 lb. cotton-seed meal 400 lb. basic slag 100 lb. sulphate of potash	} without mulch
8	0.414	No manure	600 lb. mixed fertilizer (8-10-4)	} without mulch
9	0.373	5 tons-mulch	600 lb. mixed fertilizer (8-10-4)	} 5 tons mulch
10	0.40	2½ tons mulch 500 lb. lime	400 lb. mixed fertilizer (8-10-4) 500 lb. lime	} 2½ tons mulch

Plant Legislation in Dominica.

The first step in the direction of plant protection was taken in 1898, when Act No. 3 was passed to provide against the importation of articles likely to introduce diseases among plants. Under the authority of this Act, a Proclamation dated August 27, 1898, prohibited the importation from Ceylon of plants, seeds, berries, earth and soil. This Act was suspended by Law No. 9 of 1904, in which provision is made for the fumigation and disinfection of imported plants, cuttings, buds, grafts, bulbs, roots, and seeds, and their packages: also fruit and vegetables intended for propagation, and not for consumption as food.

Under Law No. 6 of 1907, power is conferred to prohibit by proclamation the importation of plants, cuttings, bulbs, roots, seeds, or berries, or any earth or soil, or any articles packed therein, or any packages, or other articles or things likely to be the means of introducing any plant disease.

PLANT LEGISLATION.

A Proclamation dated February 5, 1909, under No. 6 of 1907, prohibits the importation into Dominica of all plants from Dutch Guiana, which are likely to be a means of introducing disease from that country.

A Proclamation dated October 26, 1910, prohibits the importation of banana plants and suckers from all countries of Central or South America, and from the island of Trinidad, also of coco-nuts in husk, and all growing plants or parts of plants of coco-nuts, from Cuba, Jamaica, Trinidad, and all countries of Central or South America.

A Proclamation dated October 9, 1916, restricts under certain conditions, the entry of rooted plants of all kinds from the United States of America, Cuba, Jamaica, Haiti, San Domingo, and Porto Rico.

A Proclamation dated October 29, 1917, prohibits the importation of seed-cotton or cotton seed from all countries or places outside the Colony of the Leeward Islands, save and except from some other Presidency of the Colony, or from the Colony of Trinidad and Tobago, and its dependencies, or from the Colonies of Grenada, St. Vincent, and St. Lucia, provided, however, that small quantities of cotton seed for experimental purposes may be imported into the Presidency of Dominica, on the written permission of the Superintendent of Agriculture, on such terms and conditions as he may prescribe.

A Proclamation dated March 8, 1919, prohibits the importation from the islands of Trinidad and Grenada of growing and sprouting coco-nuts, as likely to be a means of introducing the plant disease known hitherto as 'Root disease of coco-nuts' but to be called in future the 'Red Ring disease of coco-nuts'.

A Proclamation dated December 21, 1920, prohibits from any other country into this Presidency, the importation of sugar-cane for the time being.

A Proclamation dated February 21, 1921, prohibits from any other country into this Presidency, the importation of Johnson Grass (*Bolcus halepensis*).

A Proclamation dated January 28, 1923, prohibits the importation of Banana plants, (suckers), from all countries except other Leeward Islands, Grenada, St. Vincent, and Barbados.

A Proclamation dated February 20, 1923, prohibits the importation of citrus plants from all countries except the Windward & Leeward Islands, Trinidad & Tobago, and Barbados. It is, however, allowed that the Curator or agricultural officer shall have the power to import for scientific purposes anything thus prohibited, on his making a report of such importation for the information of the Governor.

The above Proclamation revokes two previous proclamations dated October 9, 1916, and March 8 1919, respectively.

With regard to the export of plants, it is only necessary to state that such cannot be admitted into the United States unless accompanied by a certificate showing that they have been inspected by a duly authorized official, and found free from injurious plant diseases or insect pests.

EXPENDITURE.

Salaries, Curator, Assistant Curator Foreman, Clerk, and Watchman	£	s.	d.
903	0	0	
Contingencies	10	0	0
Travelling Expenses	50	0	0
Maintenance	280	0	0
Cultivation of saleable products	275	0	0
Fumigation of imported plants	5	0	0
Maintenance, Public Gardens	15	0	0
Purchase of special manures	80	0	0
Printing reports, etc.	40	0	0
Experiment Station	350	0	0
Purchase of vegetable seeds	25	0	0
Trial shipments of fruit	20	0	0
Chemicals and Apparatus	25	0	0
Telephone rental	14	10	0
Uniform for Watchman	3	0	0
Purchase of Garden seats	10	0	0
Agricultural Instruction	160	0	0
Total	£2,265	10	0

The actual expenditure during the year under the above heads was £2,060. 1. 5.

					£	s	D.
Printing Guide Book	...	...	...	...	16	0	9
Prof. Ashby's visit to Dominica	...	...	...	...	18	3	9
Dusting Materials	...	...	...	...	7	11	11
Assistant Curator's visit to Florida	...	...	...	...	114	4	8
					£156	1	1

Limes	...	...	...	...	...	...	423	1	2
Cacao	...	...	...	...	...	...	155	5	1
Fruit	...	...	...	...	...	...	50	3	0
Plants	...	...	...	...	...	...	45	16	0
Vegetable seeds	...	...	...	...	...	...	12	6	10
Nutmegs	...	...	...	...	...	...	12	13	6
Miscellaneous	...	...	...	...	...	...	8	16	11
							708	2	9

STAFF CHANGES.

There is nothing to report under this head.

ADDITIONS AND REPAIRS.

Minor repairs were done to one of the sheds.

CORRESPONDENCE AND DISTRIBUTION OF INFORMATION.

During the year 932 communications were despatched from the office of the Department, and 135 minute papers dealt with. Fifty-four copies of the West Indian Bulletin, 160 copies of the Annual Report on the Agricultural Department 1920-21, and 160 copies for 1921-22, were distributed free of charge to leading planters, officials, and others in the island. Of the 1921-22 Annual Reports there were also despatched abroad 220 copies.

Of literature dealing with withertip disease of limes, one hundred copies each of two separate memorandums, and 100 copies of a report by Professor Ashby, B. Sc., Mycologist on the staff of the Imperial Department of Agriculture, were printed and distributed locally to planters and other interested parties. There were also distributed 250 printed copies of a report by the Assistant Curator on his mission to Florida investigating control measures for withertip disease of limes.

As in previous years, the Department was visited by a large number of planters and others desiring information on agricultural matters.

No new books were added to the library during the year, but the publications of a number of Agricultural Departments and other Scientific Institutions, were duly received. Some of these were bound. The opportunity is again taken to thank those who kindly forward their publications.

PLANT AND SEED EXCHANGES, FOREIGN AND LOCAL.

Contributions of seeds and plants were received from the following :—

The Imperial Commissioner of Agriculture for the West Indies ; Royal Botanic Gardens, Kew ; United States Department of Agriculture ; Agricultural Department, Kuala Lumpur, Federated Malay States ; Ministry of Agriculture, Cairo, Egypt ; Superintendent of Agriculture, Leeward Islands ; The Agricultural Departments of Grenada, and Montserrat ; and the Hon. Dr. Nicholls, C.M.G.

Seeds and plants were sent to : Royal Botanic Gardens, Kew ; United States Department of Agriculture ; Ministry of Agriculture, Cairo, Egypt ; and the Division of Botany, Pretoria.

OFFICIAL AND OTHER VISITS TO THE GARDENS.

Mr. F. H. S. Warneford, B.A., B.Sc., Assistant Government Chemist for the Leeward Islands, arrived in Dominica on April 24 for the purpose of undertaking chemical investigations. Mr. Warneford sailed for Antigua on May 12.

Professor F. S. Ashby, B.Sc., Mycologist on the staff of the Imperial Department of Agriculture, arrived in the island on May 18, for the purpose of investigating withertip disease of limes. Prof. Ashby returned to Barbados on June 5.

Mr. K. W. Earle, M.Sc., F.G.S. Geologist on the staff of the Imperial Department of Agriculture, arrived in the island on March 27, and sailed for Grenada on May 22, on the completion of his Geological investigations.

METEOROLOGICAL RETURNS - RAINFALL.

Hon. A. E. Collens, F.I.C., F.C.S., Government Chemist and Superintendent of Agriculture for the Leeward Islands, arrived in Dominica on June 24, for the purpose of undertaking chemical investigations. Mr. Collens returned to Antigua on July 7.

Mr. R. S. Cunliffe, B.Sc., West Indian representative of the Nitrate Agencies, arrived in Dominica on May 12, and left on May 22 for Trinidad. During Mr. Cunliffe's stay in Dominica certain manurial plots in the Experiment Station, and manurial plots on various planters estates, received his attention.

Owing to quarantine restrictions preventing the landing of passengers, no visitors called at the Gardens during the latter half of the year.

METEOROLOGICAL RETURNS.

Temperatures and other meteorological observations, a summary of which is given in a table at another page, were recorded during the year.

RAINFALL.

The rainfall at the Botanic Gardens for 1922 amounted to 64.24 inches or 2.52 inches more than the previous year, and 12.37 inches less than the average annual precipitation for the last thirty years, which is 76.61 inches.

The following table shows the mean monthly and annual rainfall at the Botanic Gardens from 1893 to 1922, a period of thirty years.

Following the above will be seen the monthly rainfall at the twenty-six recording stations located in different parts of the island. The thanks of the Department are due to those planters who furnish the information from year to year.

RAINFALL AT THE BOTANIC STATION, DOMINICA, 1895-1922.

Month.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921.	1922.	Mean monthly rainfall.
a.	4.08	5.52	2.60	3.00	6.78	2.25	4.52	2.01	3.10	7.92	3.86	3.74	4.48	1.56	2.30	5.20	11.46	8.21	7.48	3.22	1.76	10.79	5.00	6.02	2.49	7.54	6.82	6.50	5.13
b.	1.09	1.23	3.21	2.11	3.00	1.15	0.88	0.43	5.01	5.58	2.56	2.01	3.82	1.16	5.02	11.12	4.00	1.32	2.32	5.56	1.04	1.90	4.10	8.73	1.52	4.76	1.02	4.30	3.43
March	5.35	2.73	3.36	1.53	1.32	3.56	3.27	2.69	2.44	2.16	4.38	0.90	1.96	3.68	2.08	1.16	3.11	4.60	7.29	2.23	0.81	4.52	6.74	3.32	0.69	3.80	4.16	2.80	3.14
April	2.92	1.27	1.39	0.75	0.60	1.29	0.25	2.80	0.57	1.61	1.90	3.18	2.66	3.08	8.12	2.86	5.00	3.38	1.57	6.45	15.75	1.22	0.47	1.86	2.36	.22	3.06	2.26	2.86
May	10.08	6.12	12.75	1.19	1.76	7.62	2.05	6.86	2.11	1.58	4.32	3.78	1.61	2.24	1.92	7.30	11.16	1.56	3.46	2.58	3.65	2.05	2.94	5.90	4.60	2.38	1.54	2.61	4.22
June	3.19	8.23	6.50	11.78	7.23	5.59	12.18	12.89	9.92	6.00	5.51	9.16	5.54	6.16	9.00	14.26	6.51	5.44	3.49	7.27	9.17	4.82	15.34	6.04	3.88	3.18	1.96	7.11	7.71
July	7.13	14.88	8.80	11.75	10.08	10.50	22.96	9.74	8.91	10.38	6.10	10.10	8.00	9.22	9.86	12.60	8.08	5.83	7.57	11.83	11.84	8.23	13.70	11.28	12.64	12.08	11.18	6.08	10.65
Aug.	9.67	7.07	8.87	16.35	6.32	7.34	13.53	7.41	18.41	7.69	14.18	7.30	7.40	9.41	13.12	10.22	11.43	1.88	10.93	3.98	14.74	16.58	8.53	8.46	9.64	8.76	9.30	9.26	9.95
Sept.	17.72	6.47	4.51	7.89	7.04	5.28	5.86	8.62	9.69	11.32	8.92	10.88	11.60	7.52	6.11	8.90	15.31	3.32	8.39	7.71	11.36	6.20	15.02	4.14	7.06	8.60	6.28	10.68	8.74
Oct.	11.2	3.93	8.42	7.97	1.81	6.60	4.84	5.75	12.73	10.21	9.10	8.12	7.80	5.12	13.10	3.82	7.06	7.26	10.40	5.13	8.41	10.06	2.46	6.67	7.50	12.60	9.41	2.68	7.79
Nov.	11.21	16.81	7.81	6.55	5.02	3.49	6.43	11.20	4.17	3.15	5.48	9.58	5.98	1.96	4.36	5.40	6.91	11.20	4.28	9.44	10.05	14.28	1.92	3.36	9.02	4.62	2.44	3.00	6.63
Dec.	5.66	6.60	10.55	5.86	2.19	3.68	4.32	7.16	14.23	4.84	5.72	2.94	8.42	7.30	5.82	7.50	7.14	6.66	2.72	9.70	8.40	3.77	4.58	5.86	6.70	5.62	4.22	6.90	6.37
Total	89.12	80.86	78.77	79.73	53.15	58.35	81.09	77.56	90.72	72.45	72.06	72.02	69.30	58.91	81.11	90.64	97.26	63.72	69.90	75.10	100.01	84.42	80.80	71.46	68.03	71.46	61.72	64.21	

RAINFALL RETURNS, DOMINICA, 1922.

Station.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
Bagatelle, Soufrière	4.99	4.31	4.84	3.33	4.22	8.14	4.34	9.88	9.95	4.66	5.59	2.70	66.95
Batalie	3.46	2.83	1.37	1.95	1.38	3.94	4.09	9.74	7.87	1.18	2.60	2.45	42.86
Bellevue	12.70	16.30	12.56	11.43	9.81	13.32	10.22	16.40	20.89	10.80	9.00	6.98	150.41
Blenheim	7.00	7.04	8.70	16.22	4.98	7.97	6.55	13.68	14.47	4.21	5.89	3.55	100.26
Botanical Gardens	6.50	4.30	2.80	2.26	2.64	7.14	6.08	9.26	10.68	2.68	3.00	6.90	64.24
Canefield	6.06	3.94	3.21	3.51	3.25	7.00	6.18	11.68	14.64	2.83	2.42	5.06	69.78
Castle Bruce	5.38	8.39	9.18	8.36	4.67	5.87	4.17	15.32	21.26	15.03	20.60	3.57	121.80
Elveton	6.72	6.78	4.90	3.66	5.18	11.23	7.54	13.40	14.39	4.43	3.04	4.23	85.50
Goodwill	6.30	4.85	4.15	2.61	3.07	9.04	6.20	9.88	10.65	3.17	3.38	6.64	69.94
Governor	9.44	8.63	12.15	15.98	7.68	8.43	6.69	11.14	20.34	8.96	12.15	4.71	126.30
Hampstead	5.00	5.55	6.64	12.30	3.92	5.88	4.68	9.71	11.85	4.22	5.07	2.88	77.70
Hillsborough	4.89	6.75	4.13	5.82	2.84	7.52	7.20	12.34	11.05	3.61	3.00	4.48	73.63
Indian River	9.74	8.48	9.49	9.89	3.31	8.66	7.58	15.14	14.58	3.59	5.06	5.27	100.79
Kinellan	8.17	10.37	14.98	12.50	3.89	15.15	12.31	20.80	13.92	7.86	9.45	10.72	140.12
La Haut	3.55	3.50	5.25	3.65	4.05	10.65	9.90	13.03	14.02	5.20	3.05	5.40	81.25
Lakeside	26.95	32.91	36.61	32.89	21.81	29.01	27.36	34.15	46.37	25.27	30.56	15.18	359.10
Londonderry	6.07	4.05	6.85	4.77	3.35	5.75	5.11	8.37	11.37	7.81	9.84	2.16	75.50
Moore Park	9.20	8.09	9.93	13.50	9.30	9.42	7.25	16.45	11.15	3.39	4.23	4.60	106.46
Morne Bruce	7.21	4.93	3.85	2.25	3.07	7.95	7.14	11.53	12.82	3.43	3.60	6.23	74.01
Picard	14.98	2.26	8.95	5.15	1.25	3.56	11.83	11.32	7.59	6.99	9.46	6.86	90.20
Pte. Mulâtre	7.27	7.89	6.64	12.72	6.78	8.13	4.83	10.52	17.72	7.43	12.08	2.79	104.80
Rosalie	8.45	8.28	10.00	12.15	5.35	9.73	6.80	10.65	16.75	11.10	15.60	5.02	119.88
Shawford	12.48	14.48	15.93	14.83	8.85	25.24	13.95	33.66	33.02	8.40	7.13	8.45	196.42
Snug Corner	7.70	7.90	8.42	3.81	2.30	8.66	21.05	5.30	8.75	2.55	8.80	8.17	83.74
Soufrière	4.85	6.45	5.31	3.81	5.10	4.71	9.23	9.23	10.86	7.16	7.19	2.92	76.25
St. Arment	8.45	6.24	5.20	4.13	4.41	8.84	10.21	11.76	13.93	4.19	2.90	9.03	89.29
Woodford Hill	3.21	5.40	4.22	6.01	2.70	4.22	...	...	...	...	...	...	...
			Mean	Rainfall	26	Stations	...	...	105.66	...	...	...	...
			"	"	14	Leeward Stations	...	...	76.31	...	...	...	...
			"	"	3	Windward	...	...	115.49	...	...	...	...
			"	"	4	Inland	...	...	211.51	...	...	...	...
			"	"	5	Lasoye	...	...	97.24	...	...	...	...

METEOROLOGICAL.

SUMMARY OF METEOROLOGICAL REGISTER,

KEPT AT BOTANIC GARDENS, DOMINICA.

1922. Months.	Thermometer.			Relative Humidity.		Thermometer.		Barometer Corrected.		Wind. Average per hour per day.	Barometer Corrected.		Thermometers.		REMARKS.
	Dry.		Wet.	Minimum.		Maximum.		Reduced to 32° Fh. and Sea Level.			Lowest.	Highest.	Highest Max.	Lowest Min.	
9 a.m.	3 p.m.	9 a.m.	3 p.m.	9 a.m.	3 p.m.	9 a.m.	3 p.m.	9 a.m.	3 p.m.	9 a.m.	3 p.m.	9 a.m.	3 p.m.	9 a.m.	3 p.m.
January	77.7	80.1	72.1	72.5	73.2	64.8	87.7	67.6	30.07	29.99	1.9	30.16	29.90	91	65.3
February	75.8	79.7	71.7	72.3	80.0	66.4	86.4	68.6	30.09	30.03	2.3	30.18	29.99	89	65.0
March	76.5	80.0	71.2	71.9	74.1	63.1	85.2	68.7	30.08	30.04	2.1	30.17	29.97	90	66.0
April	80.6	82.6	73.1	73.0	66.5	58.6	89.3	69.5	30.11	30.05	2.0	30.17	29.99	93	67.0
May	83.5	84.1	74.1	73.4	60.3	55.5	91.4	70.1	30.07	30.02	1.7	30.12	29.97	94	67.0
June	81.7	83.6	74.5	74.8	67.8	61.8	89.2	72.0	30.08	30.04	1.7	30.17	29.98	93	69.0
July	81.8	83.8	75.3	75.4	75.0	63.3	89.5	72.5	30.11	30.08	1.6	30.17	30.05	93	69.0
August	80.6	83.6	75.8	75.3	77.4	64.7	88.4	72.0	30.05	30.01	1.4	30.11	29.95	93	70.0
September	80.6	82.8	76.3	77.0	79.5	72.6	88.9	72.6	30.02	29.97	2.0	30.10	29.89	92	69.0
October	81.5	83.7	76.1	76.2	74.7	66.2	90.7	71.5	30.02	29.95	1.8	30.10	29.86	93	70.0
November	80.4	82.2	74.1	74.2	71.1	64.3	90.7	70.4	30.02	29.94	2.2	30.11	29.87	94	67.0
December	77.2	80.0	72.4	72.0	77.0	64.0	87.8	69.0	30.08	30.01	1.9	30.17	29.95	91	65.0

Highest Maximum Temperature = 94° on May 9, and November 6, Lowest Minimum Temperature = 65.0 on February 6, and December 20.
 Highest Barometer (Corrected) = 30.18 on February 7. Lowest Barometer (Corrected) = 29.86 on October 11. Greatest Rainfall in 24 hours = 2.28 inches on June 16.



Publications on Sale OF THE IMPERIAL DEPARTMENT OF AGRICULTURE

FOR THE WEST INDIES.

The 'WEST INDIAN BULLETIN' Quarterly Scientific Journal.

Volume I :—Full reports of the Agricultural Conference of 1899 and 1900.

Only a very limited number of copies of the parts of Volume I are available, and these cannot be sold separately. Volume I complete in original paper covers as issued, post free, 5s.

Volume II, III, IV, V, and VI :—Price 2s. each. Post free 2s. 8d.

Volume VIII, Nos. 1, 2, and 3 :—West Indian Agricultural Conference, 1907; Abstract of Proceedings and Reprints of Papers. No. 4 :—Agricultural Conference, 1908; Presidential Address and Abstract of Proceedings. Price 6d. each number. Post free, 8d.

Volume IX, Nos. 1, 2, 3, and 4 :—Reprints of papers read at Agricultural Conference 1908, with summaries of discussions following. Price 6d. each number. Post free, 8d.

Volume X, Nos. 1, 2, 3, and 4 :—Paper on general Subjects. Antigua Agricultural Conference.

Volume XI, Nos. 1, 2, 3, and 4 :—Papers on General Subjects. Account of Imperial Department of Agriculture in the West Indies.

Volume XII, Nos. 1, 2, 3, and 4 :—Papers on the Agricultural Conference, 1912.

Volume XIII, No. 1.—Containing Papers on COTTON and AGRICULTURAL EDUCATION, prepared for the recent Agricultural Conference.

Volume XIII, No. 2.—Containing Papers on SUGAR-CANE EXPERIMENTS IN BRITISH GUIANA, prepared for the recent Agricultural Conference.

Volume XIII, No. 3.—Containing Papers on RUBBER and MISCELLANEOUS SUBJECTS, prepared for the recent Agricultural Conference.

Volume XIII, No. 4.—Containing Papers on FORESTRY, SUGAR-CANE COTTON, LIMES, ETC.

Volume XIV, No. 1.—Containing Papers on PEASANT AGRICULTURE IN THE WEST INDIES.

Volume XIV, No. 2.—Containing Papers on CHEMISTRY, VETERINARY SCIENCE, ETC.

Volume XIV, No. 3.—Containing Papers on VETERINARY SCIENCE, AGRICULTURAL EDUCATION, ANALYTICAL METHODS, and PESTS AND DISEASES.

Volume XIV, No. 4.—Containing Papers on WEST INDIAN INDUSTRIES, WATER-SUPPLY, and PLANT DISEASE.

Volume XV, Nos. 1, 2, and 3.—Containing Papers on General Subjects.

Volume XV, No. 4.—Containing an account of the Proceedings of the West Indian Cotton Conference 1916.

Volume XVI, Nos. 1, 2, 3, and 4.—Containing Papers on General Subjects.

Volume XVII, Nos. 1, 2, 3, and 4.—Containing Papers on General Subjects, especially cotton.

Volume XVIII, Nos. 1, 2, 3 and 4.—Containing Tropical Agricultural College Committee's Report, and Papers on Miscellaneous Subjects.

PAMPHLET SERIES.

The following list gives particulars of the chief pamphlets issued by the Imperial Department of Agriculture that are still available :—

SUGAR INDUSTRY.

Seedling and other Canes at Barbados, 1900-4.

Seedling Canes and Manurial Experiments at Barbados,

in 1903-5, No. 40,	in 1904-6, No. 44,	} price 6d. each.
in 1905-7, No. 49,	in 1906-8, No. 59,	
in 1907-9, No. 62,	in 1908-10 No. 66,	

Seedling and other Canes in the Leeward Islands,

in 1900-1, No. 12,	in 1901-2, No. 20,	} price 2d. each,
in 1902-3, No. 27,		

in 1903-4, No. 33,	in 1904-5, No. 39,	} price 4d. each.
in 1905-6, No. 46,	in 1906-7, No. 50,	
in 1907-8, No. 56,		

in 1908-9, No. 63,	in 1909-10, No. 67—	price 6d. each.
--------------------	---------------------	-----------------

Manurial Experiments with Sugar cane in the Leeward Islands,

in 1902-3, No. 30,	in 1903-4, No. 36,	} price 4d. each.
in 1904-5, No. 42,	in 1905-6, No. 47,	
in 1906-7, No. 51,	in 1907-8, No. 57,	
in 1908-9, No. 64,	in 1909-10, No. 68,	

Sugar-cane Experiments in the Leeward Islands,

in 1910-11, price 1s. ; in 1911-12, price 1s.

SCALE INSECTS.

Scale Insects of the Lesser Antilles, Part I, No. 7, price 4d.

Part II, No. 22, price 4d.

GENERAL.

82(43) Cotton Seed and Cotton-cake-meal on West Indian Plantations.

Price 2d.

(52) Hints for School Gardens. Price 6d.

(60) Cotton Gins. How to erect and work them. Price 4d.

(61) The Grafting of Cacao. Price 4d.

(65) Hints for School Gardens. Fourth Edition. Price 4d.

(71) Insect Pests of the Lesser Antilles. Price 1s. 3d.

(72) Lime Cultivation in the West Indies. Price 9d.

(73) Root Borers and other Grubs in West Indian Soils. Price 6d.

(74) Cotton Cultivation in the West Indies. Price 9d.

(75) Insect Pests of Sugar-cane in Antigua and St. Kitts. Price 6d.

(76) Indian Corn. Price 4d.

(77) Erysipelas and Hoose. Price 2d.

(78) Onion Cultivation. Price 3d.

(79) Diseases of Lime Trees in Forest Districts. Price 3d.

(80) Hints to Settlers, St. Lucia. Price 6d.

(81) Agricultural and Economic Resources of St. Lucia. Price 3d.

The above will be supplied post free for an additional charge of 4d. for the pamphlets marked 2d.; 1d. for those marked 4d.; and 1½d. for Nos. 40, 41, 44, 45, 49, 59, 62, 63, 67, 73, 74 and 75; 2d. for No. 72 and 4d. for No. 71.



AGRICULTURAL NEWS*.

The Fortnightly Illustrated Review of the Imperial
Department of Agriculture for the West Indies.

The principal features of the AGRICULTURAL NEWS are as follows:—

Editorials on topics of current interest in the Tropics.

Notes and Comments on Miscellaneous subjects.

Articles dealing with

The Sugar Industry;

Fruit and Fruit Trees (Citrus, Cacao, Coco-nuts, etc.);

Cotton.

Special features include

Insect Notes (by the Entomologist);

Fungus Notes (by the Mycologist);

Down the Islands (Items of local interest);

Gleanings' page;

Reviews of new books and Departmental Reports

Miscellaneous Notes;

Market Reports.

All applications for copies of the *Agricultural News* should be addressed to the Agents, and not to the Department. A complete list of the London and Local Agents is as follows:—

London: Messrs. DULAU & Co., Ltd., 34-36, Margaret Street, Cavendish Square, London, W., 1.

WEST INDIA COMMITTEE, 15, Seething Lane, London, E.C., 3.

Canada: Mr. LEWIS W. CLEMENS, 801, Yonge Street, Toronto.

Barbados: THE ADVOCATE COMPANY, Limited, Bridgetown.

Jamaica: THE EDUCATIONAL SUPPLY COMPANY, 16, King St., Kingston.

British Guiana: THE ARGOSY Co., Ltd., Georgetown.

British Honduras: Mr. PERCY GEORGE, 'Clarion Office', Belize.

Trinidad: Messrs. MUIR, MARSHALL & Co., Port-of-Spain.

Tobago: Mr. C. L. PLAGEMANN, Scarborough.

Grenada: Messrs. THOS. LAWLER & Co., St. George.

St. Vincent: Mr. FLORIS SIMMONS, Experiment Station.

St. Lucia: Mr. R. W. NILES, Botanic Station.

Dominica: Mr. W. G. HUTTON, Botanic Garden.

Montserrat: Mr. W. ROBSON, Botanic Station.

Antigua: Mr. J. ANJO, St. John's.

St. Kitts: THE BIBLE AND BOOK SUPPLY AGENCY, Basseterre.

Nevis: Mr. W. I. HOWELL, Experiment Station.

Bahamas: Mr. N. D. SANDS, Board of Agriculture, Nassau.

The price of the *Agricultural News* is 1d. per number, post free, 1½d. Annual subscription payable to the agents, 2s. 2d., post free, 3s. 3d. per annum. Subscription abroad 4s. 4d.; in Great Britain 5s. 5d. Volumes VIII to XIX complete, with title page and index as issued—Price 4s. each, post free 5s. Only a few copies available. The scale of charges for advertisements may be obtained on application to the agents as above.

*This publication ceased on 18th March, 1922.